# NEC

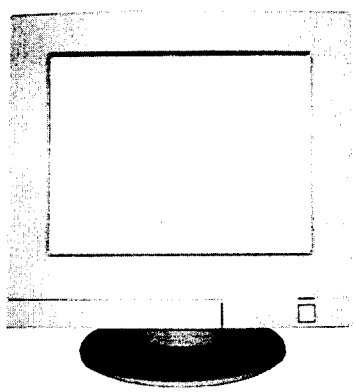
**MODELS JC-1531VMA(N),(H),(NT)/
B(N), B(H), B(NT)/
R(N), R(H)/
B(EE)(N), B(EE)(H), B(EE)(NT)**

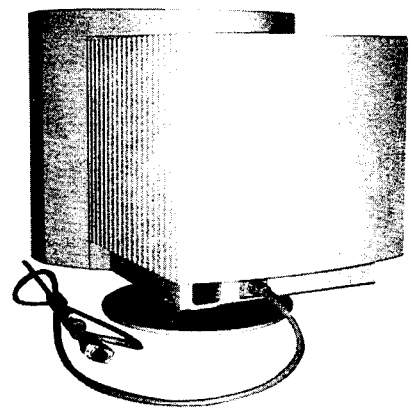
## COLOR MONITOR MultiSync 4FG

# SERVICE MANUAL

PART NO. 599910333

**Better Service**
**Better Reputation**
**Better Profit**





## SPECIFICATIONS

### A. Electrical Description

| | | |
|---|---|---|
| Picture Tube | 15" Flat Square CRT 14 Visual inches diagonal<br>90 degree deflection, 0.28 mm dot pitch<br>Dot type black matrix, Medium-short persistence phosphor, Dark bulb, High contrast, Anti-static coating, Invar shadow mask. | |
| Input Signal | Video : Analog 0.7 Vp-p 75Ω Positive | |
| | Sync : Separate sync | TTL Level |
| | Horizontal sync | Positive/Negative |
| | Vertical sync | Positive/Negative |
| | : Composite sync | TTL Level<br>Positive/Negative |
| | : Composite sync on green Video sync 0.3 Vp-p Negative (Video 0.7 Vp-p Positive) | |
| Display Colors | Analog Input : Unlimited colors | |

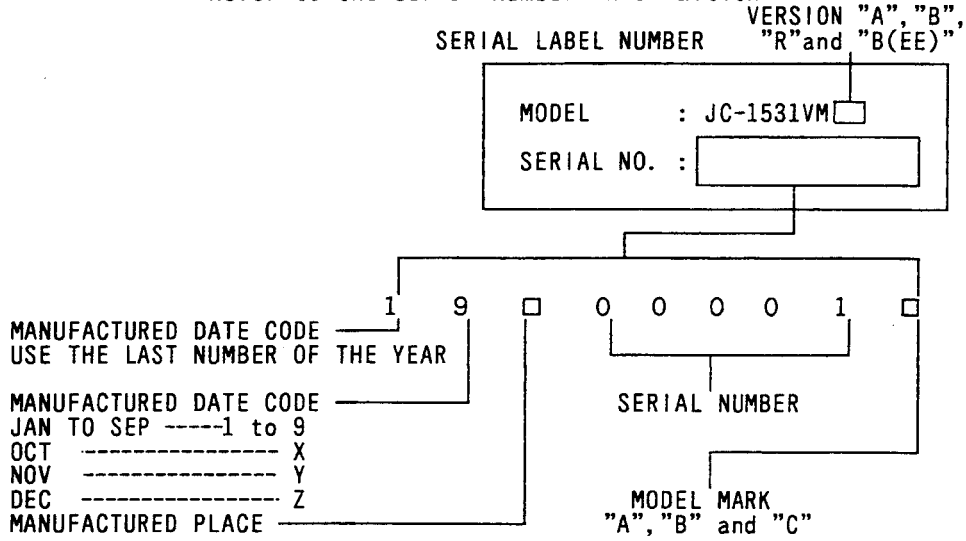
| | | |
|---|---|---|
| Synchronization | Horizontal : 27 kHz to 57 kHz (Automatically) | |
| | Vertical : 55 Hz to 90 Hz (Automatically) | |
| Resolution | Horizontal : 1024 dots | |
| | Vertical : 768 dots (non-interlaced) | |
| Video Band Width | 75 MHz | |
| Active Display Area | Horizontal : 260 mm<br>Vertical : 195 mm | (Active display area is changed by signal timing) |
| Active Display Area Fullscan | Horizontal : 280 mm<br>Vertical : 210 mm | |
| Miconvergence | Less than 0.5 mm around perimeter less than 0.3 mm at center | |
| Power Supply | JC-1531VMA | AC 120 V, 60 Hz |
| | JC-1531VMB/R/B(EE) | AC 220 V, 50 Hz |
| Current Rating | JC-1531VMA 1.8 A<br>JC-1531VMB/R/B(EE) 1A | |
| Environmental Considerations | Operating Temperature 0°C to +35°C<br>Humidity 30% to 80% | |
| | Storage Temperature −20°C to +60°C<br>Humidity 10% to 90% | |

**NOTE:** The above specifications are subject to change without notice for further improvement.

NEC Corporation
TOKYO, JAPAN

# SERIAL NUMBER INFORMAITION

Refer to the serial number informaition




"A"----JC1531VMA(N)/B(N)/R(N)/B(EE)(N)
model applying CRT made by NEC

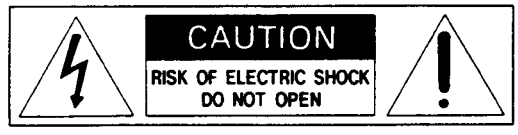
"B"----JC1531VMA(H)/B(H)/R(H)/B(EE)(H)
model applying CRT made by HITACHI

"C"----JC1531VMA(NT)/B(NT)/B(EE)(NT)
model applying DEFLECTION YOKE
made by TOTOKU

JC-1531VMA(N)/(NT)/(H) only

## WARNING

TO PREVENT FIRE OR SHOCK HAZARDS, DO NOT EXPOSE THIS UNIT TO RAIN OR MOISTURE. ALSO DO NOT USE THIS UNIT'S POLARIZED PLUG WITH AN EXTENSION CORD RECEPTACLE OR OTHER OUTLETS, UNLESS THE PRONGS CAN BE FULLY INSERTED.
REFRAIN FROM OPENING THE CABINET AS THERE ARE HIGH-VOLTAGE COMPONENTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.




CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK. DO NOT REMOVE COVER (OR BACK). NOUSER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

This symbol warns the user that uninsulated voltage within the unit may have sufficient magnitude to cause electric shock. Therefore, it is dangerous to make any kind of contact with any part inside of this unit.

This symbol alerts the user that important literature concerning the operation and maintenance of this unit has been included.

Therefore, it should be read carefully in order to avoid any problems.

# Introduction to the MultiSync 4FG color monitor

The MultiSync 4FG monitor allows you to "plug and play"; the MultiSync technology provides you with automatic compatibility with multiple operating platforms and a vast array of graphics standards allowing resolution upgrades without upgrading the monitor.

The larger 15", high contrast, flatter screen offers improved clarity and enhanced color and image quality.

ColorControl allows you to adjust the colors on your screen to exactly what you want. Thus eliminating misrepresentations and frustration.

The MultiSync 4FG monitor strictly follows ErgoDesign guidelines. ErgoDesign describes a philosophy governing the design of the MultiSync monitors. The goal of ErgoDesign is to maximize the comfort and productivity of the end user.

# Feature Highlights

## Multiple Frequency Technology

The Multiple Frequency Technology automatically adjusts the monitor to the video card's scanning frequency thus displaying the resolution you require. The MultiSync 4FG also supports multiple operating platforms including IBM compatible and Macintosh family systems.

Increased resolution adds to the image clarity, and the MultiSync 4FG monitor provides a wider range of higher resolutions to meet your needs for now and in the future.

A Wide Range of Graphics Standards is displayable by the MultiSync 4FG monitor including:

- VGA at 640×480 at 60 and 72 Hz
- SuperVGA at 800×600 56, 60, 70 and 72 Hz
- MAC II at 640×480 66.7 Hz
- 8514/A at 1024×768 Interlaced
- XGA at 1024×768 Interlaced
- 1024×768 Non-Interlaced 60 and 70 Hz

## Screen Technology

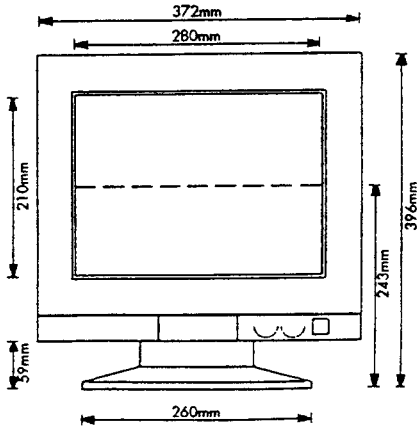
A High Contrast Tube with a 0.28 mm dot pitch increases the clarity and displays greater detail. Good clarity allows your eyes to flow over the screen image and more easily absorb the information.

The Flatter Screen of the MultiSync 4FG monitor reduces distortion of your image, and reduces reflections.

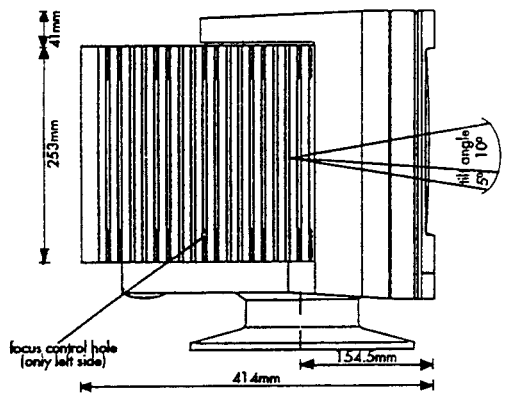
Increased Brightness provides higher contrast and more vivid colors.

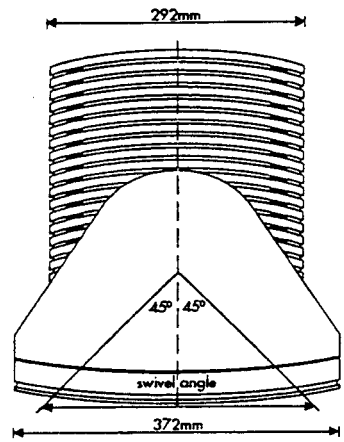
# Mechanical Description

1. Cabinet — Molded plastic cabinet with tilt swivel base.
2. Dimensions — 372 (W) × 396 (H) × 414 (D) mm




3. Tilt Swivel Range



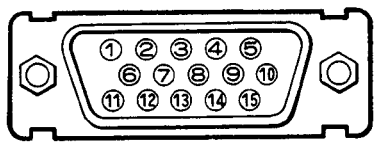




4. Weight — 17.8 kg
5. Controls — Power Switch
   Brightness Control
   Contrast Control
   Color Switch
   Sync Switch
   H Size Increase, H Size Decrease
   H Position Left, H Position right
   V Size Increase, V Size Decrease
   V Position Up, V Position Down
   Memory Recall Button
   Mode Status LED
   Degauss Switch
6. Input Signal Terminal — Mini D-SUB 15P Connector (MALE)
   D-SUB 15P Connector (MALE)
   (See page 3 for Pin Assignments Table)

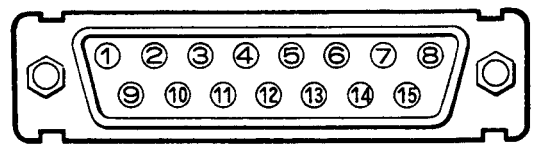
# Pin Assignment Table

## D-SUB INPUT

**MINI D-SUB 15P**



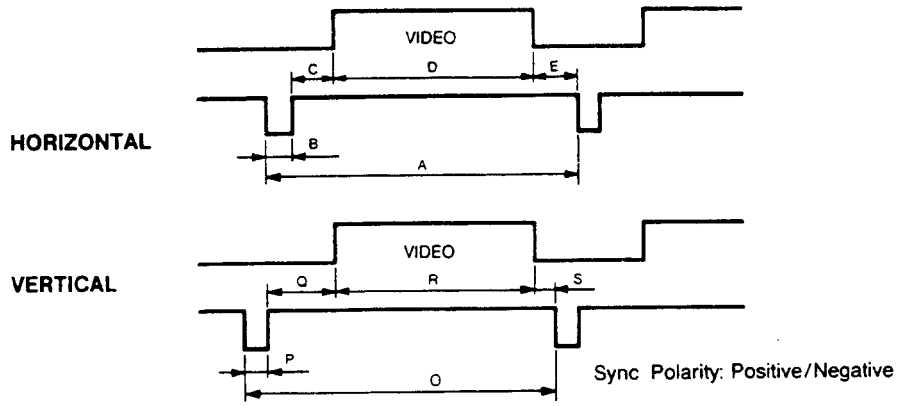

**D-SUB 15P**




| Pin No. | VGA, 8514/A & XGA<br>VGA/8514 Mini D-Sub 15P | Macintosh with Adapter<br>D-SUB 15P |
|---|---|---|
| 1 | RED | GROUND |
| 2 | GREEN | RED |
| 3 | BLUE | H/V COMP SYNC |
| 4 | GROUND | GROUND |
| 5 | SELF TEST | GREEN |
| 6 | GROUND | GROUND |
| 7 | GROUND | N.C. |
| 8 | GROUND | N.C. |
| 9 | N.C. | BLUE |
| 10 | GROUND | N.C. |
| 11 | GROUND | GROUND |
| 12 | RESERVED | N.C. |
| 13 | H SYNC | GROUND |
| 14 | V SYNC | GROUND |
| 15 | N.C. | N.C. |

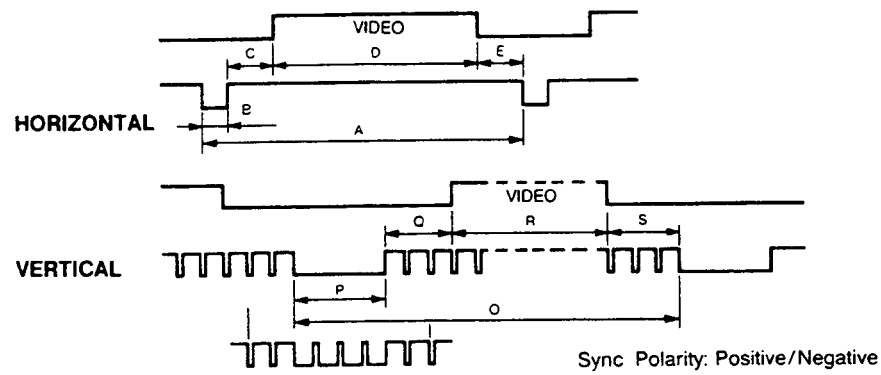
# Timing Charts

### SEPARATE SYNC.



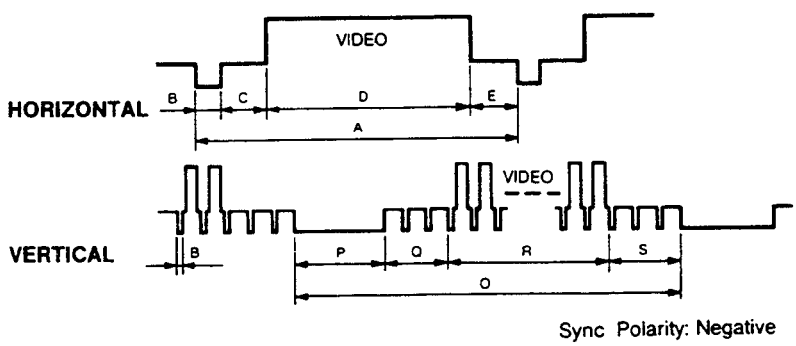

Sync Polarity: Positive/Negative

### COMPOSITE SYNC.




Sync Polarity: Positive/Negative

### COMPOSITE SYNC AND VIDEO (SYNC ON GREEN)

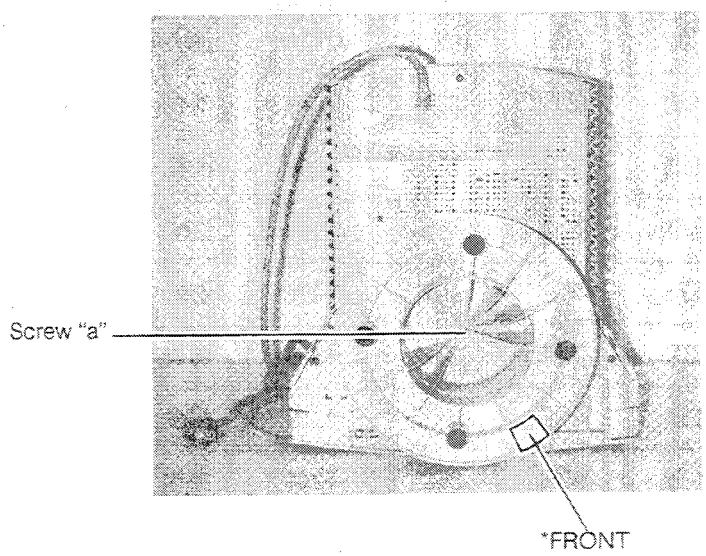



Sync Polarity: Negative

# PRESET TIMING

| | VGA/MCGA compatible | | | 8514/A & XGA | Macintosh -II | 800×600 at 56 Hz | 800×600 at 72 Hz | 1024×768 at 60 Hz | 1024×768 at 70 Hz |
|---|---|---|---|---|---|---|---|---|---|
| $f_H$ kHz | 31.47 | | | 35.52 | 35.00 | 35.16 | 48.09 | 48.36 | 56.48 |
| A μs | 31.78 | | | 28.15 | 28.57 | 28.44 | 20.79 | 10.68 | 17.71 |
| B μs | 3.81 | | | 3.92 | 2.12 | 2.00 | 2.399 | 2.09 | 1.813 |
| C μs | 1.91 | | | 1.25 | 3.17 | 3.56 | 1.279 | 2.46 | 1.92 |
| D μs | 25.42 | | | 22.8 | 21.16 | 22.22 | 15.99 | 15.75 | 13.65 |
| E μs | 0.64 | | | 0.18 | 2.12 | 0.67 | 1.119 | 0.369 | 0.32 |
| fv Hz | 70.09 | | 59.94 | 86.96 | 66.67 | 56.25 | 72.01 | 60.00 | 70.07 |
| O ms | 14.27 | 14.27 | 16.68 | 11.5 | 15.00 | 17.78 | 13.89 | 16.67 | 14.27 |
| P ms | 0.06 | 0.06 | 0.06 | 0.113 | 0.09 | 0.06 | 0.124 | 0.124 | 0.106 |
| Q ms | 1.91 | 1.11 | 1.05 | 0.563/0.5 | 1.11 | 0.63 | 0.479 | 0.6 | 0.513 |
| R ms | 11.12 | 12.71 | 15.25 | 10.81 | 13.71 | 17.07 | 12.51 | 15.88 | 13.60 |
| S ms | 1.18 | 0.38 | 0.32 | 0/0.014 | 0.09 | 0.03 | 0.772 | 0.062 | 0.053 |
| Remarks | Analog Video | Analog Video | Analog Video | Analog Video interlaced | Analog Video | Analog Video | Analog Video | Analog Video | Analog Video |

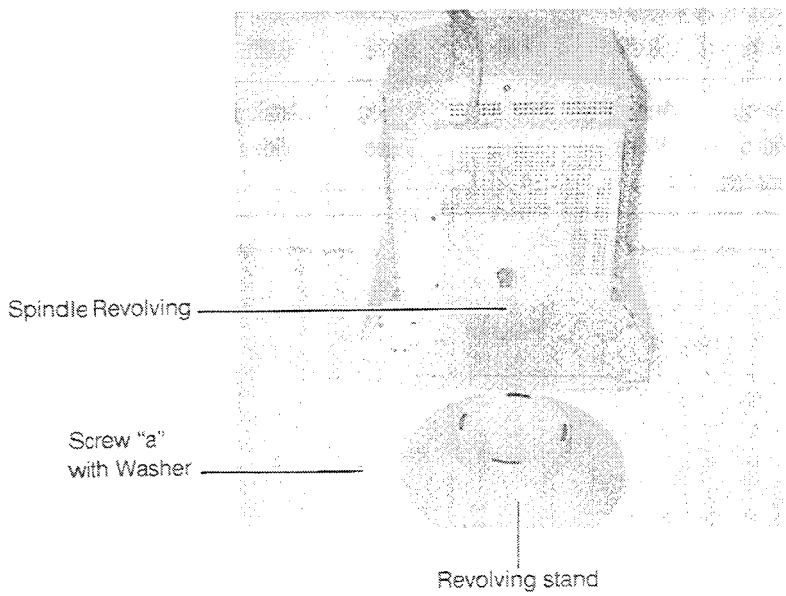
# THE METHOD FOR REMOVING THE TILT SWIVEL BASE




1. Turn the monitor CRT face down as shown. (Top VIEW)

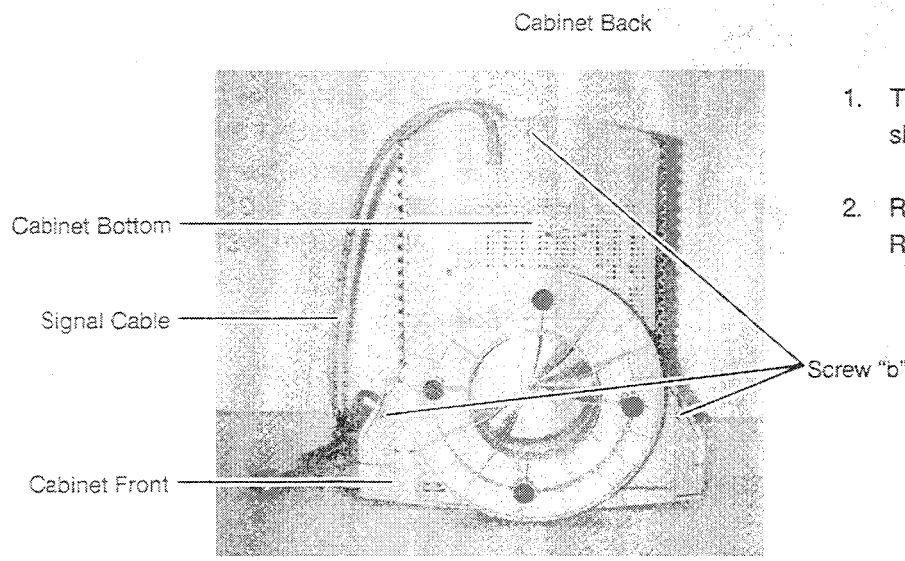
2. Remove the screw "a" with washer, then remove the revolving stand from the display.

* Move the revolving stand so that the "FRONT" mark is aligned with the cabinet side.



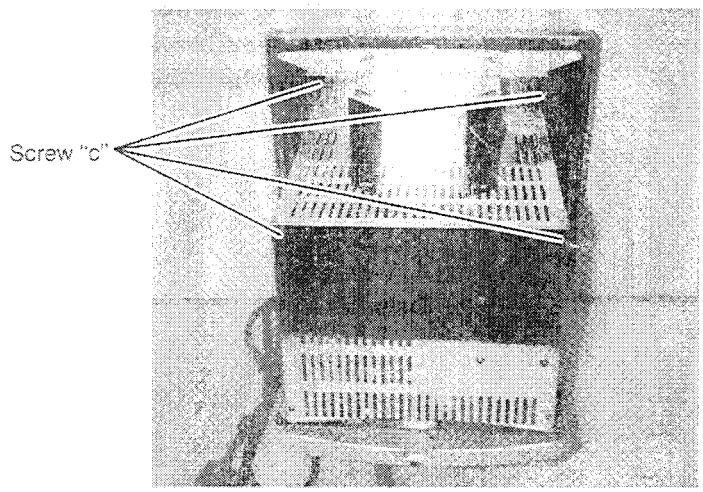

3. The removable parts consist of a display, revolving stand, spindle revolving, and screw "a" with washer as shown.

# DISASSEMBLY

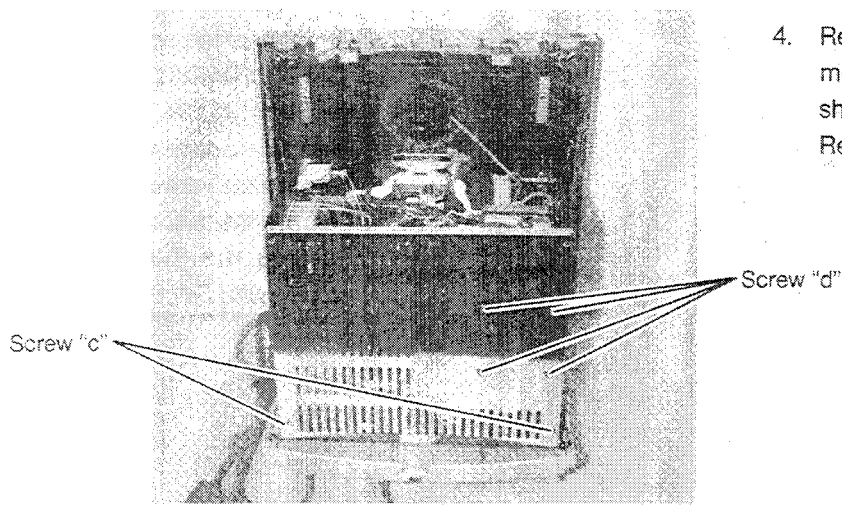



1. Turn the monitor CRT face down as shown. (Top VIEW)

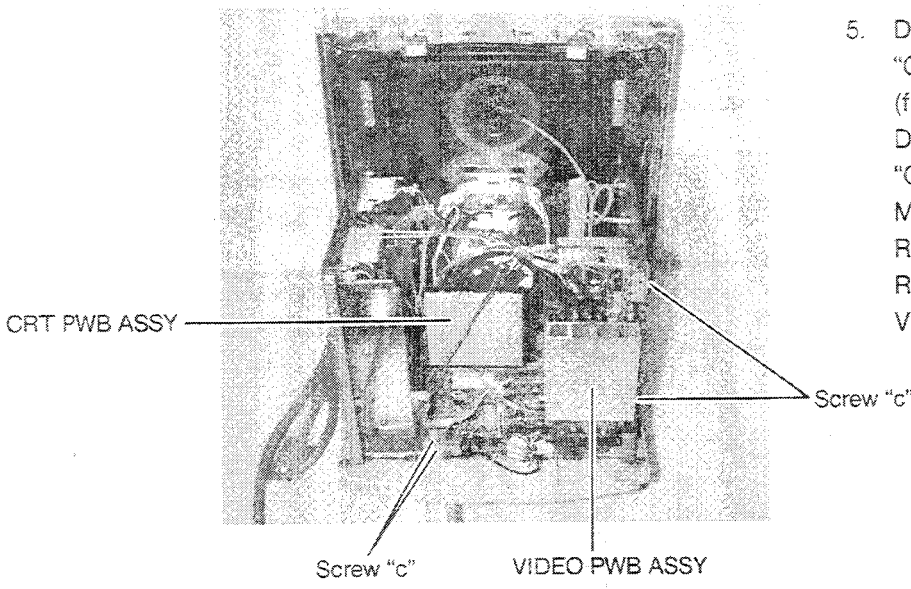
2. Remove the three screws "b". Remove the CABINET BACK.



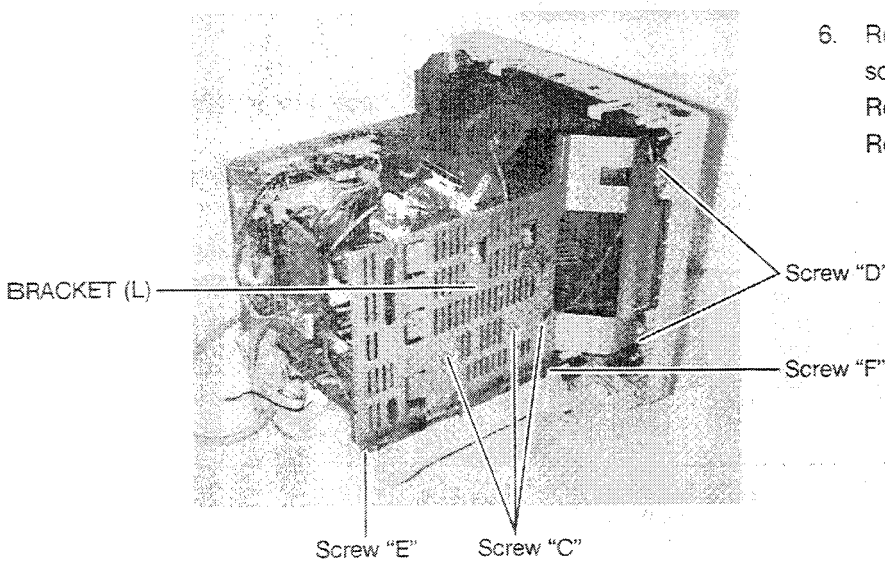

3. Place the monitor on its base as shown.
Remove the four screws "c" from the case, shielding (TOP), and remove the case, shielding (TOP).



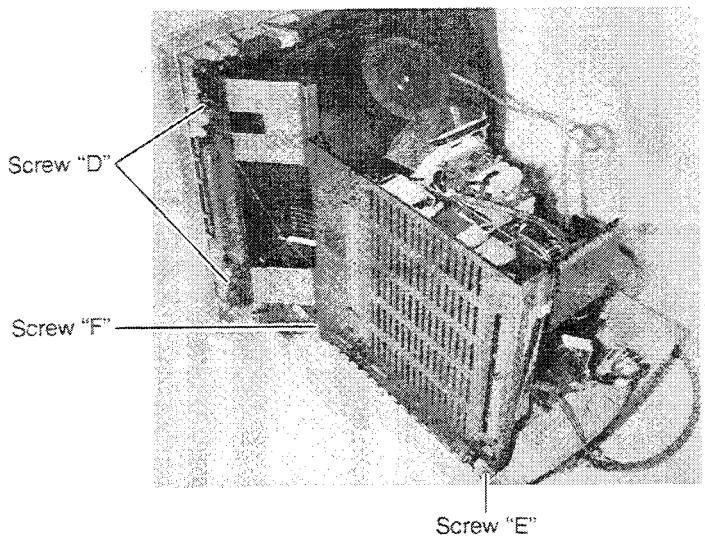

4. Remove the four screws "d" and remove the two screws "c" from the case shielding (BACK).
Remove the case shielding (BACK).



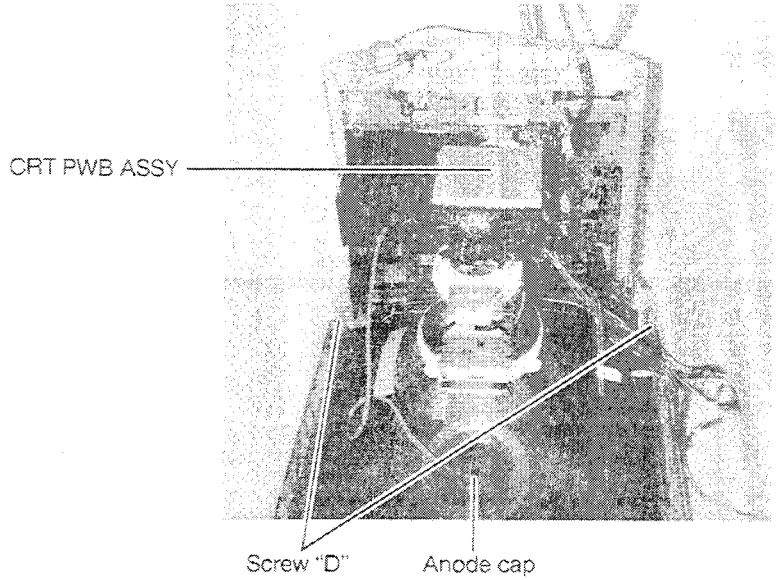

5. Disconnect the connectors "CN-J", "CN-L", "CN-C", "CN-IN" and "CN-A". (from VIDEO PWB ASSY)
Disconnect the connectors "CN-B", "CN-HC", "CN-R", "CN-G" and "CN-M". (from CRT PWB ASSY)
Remove the four screws "c".
Remove the VIDEO PWB ASSY. (with VIDEO BRACKET)




6. Remove the three screws "c" and the screw "E" and the screw "F".
Remove the two screws "D".
Remove the BRACKET (L).

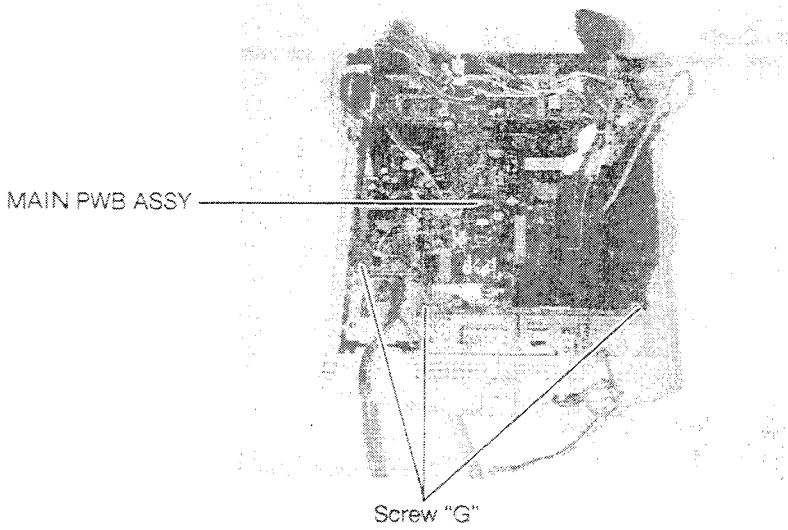



7. Disconnect the connectors "CN-SW", "CN-Z", "CN-D/C" and "CN-K". (from the SW REG UNIT)
Remove the screw "F".
Remove the screw "E".
Remove the two screws "D".
Remove the SW REG BRACKET ASSY. (with SW REG UNIT)

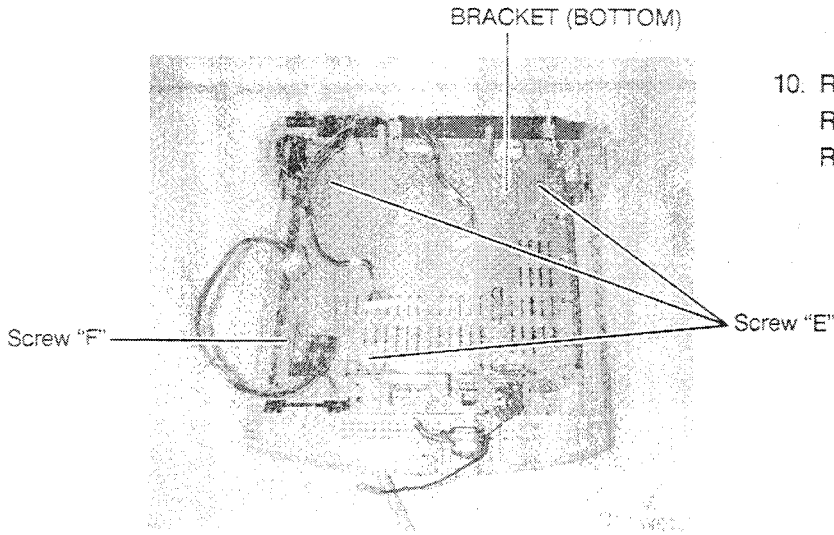



8. Turn the monitor CRT face down as shown.
   Remove the two screws "D".
   Remove the Anode cap from CRT.
   Disconnect the CRT PWB ASSY.
   Disconnect the connectors "CN-E", "CN-F", "CN-VDY", "CN-HDY" and "CN-K".

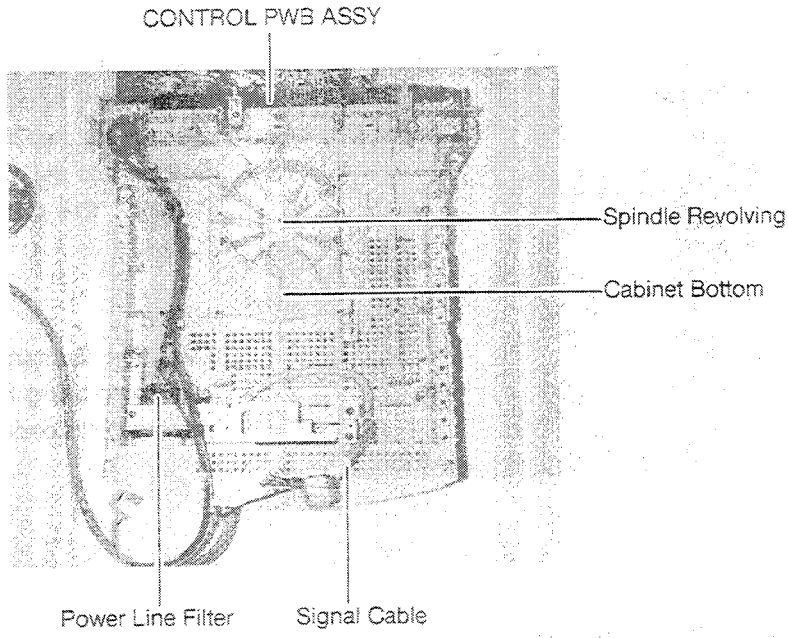
   **NOTE:**
   Carefully discharge the CRT anode cap by shorting it to ground before removing the anode cap.



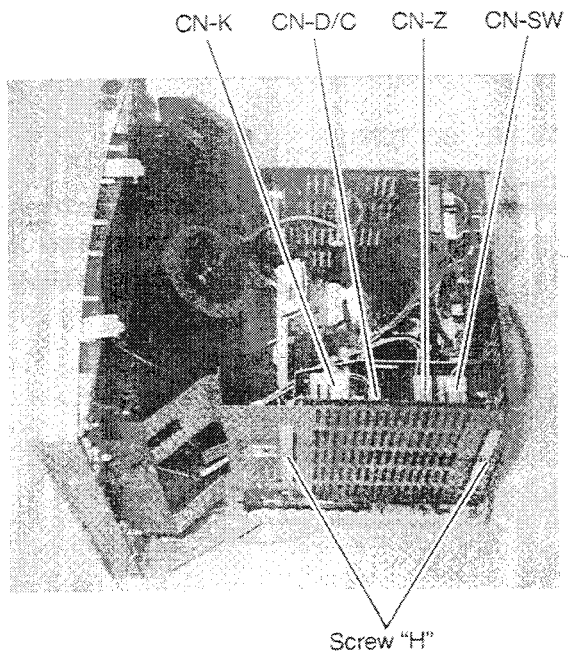

9. Remove the three screws "G".
   Remove the MAIN PWB ASSY.




10. Remove the three screws "E".
    Remove the screw "F".
    Remove the BRACKET (BOTTOM).




## SW REG UNIT DISASSEMBLY

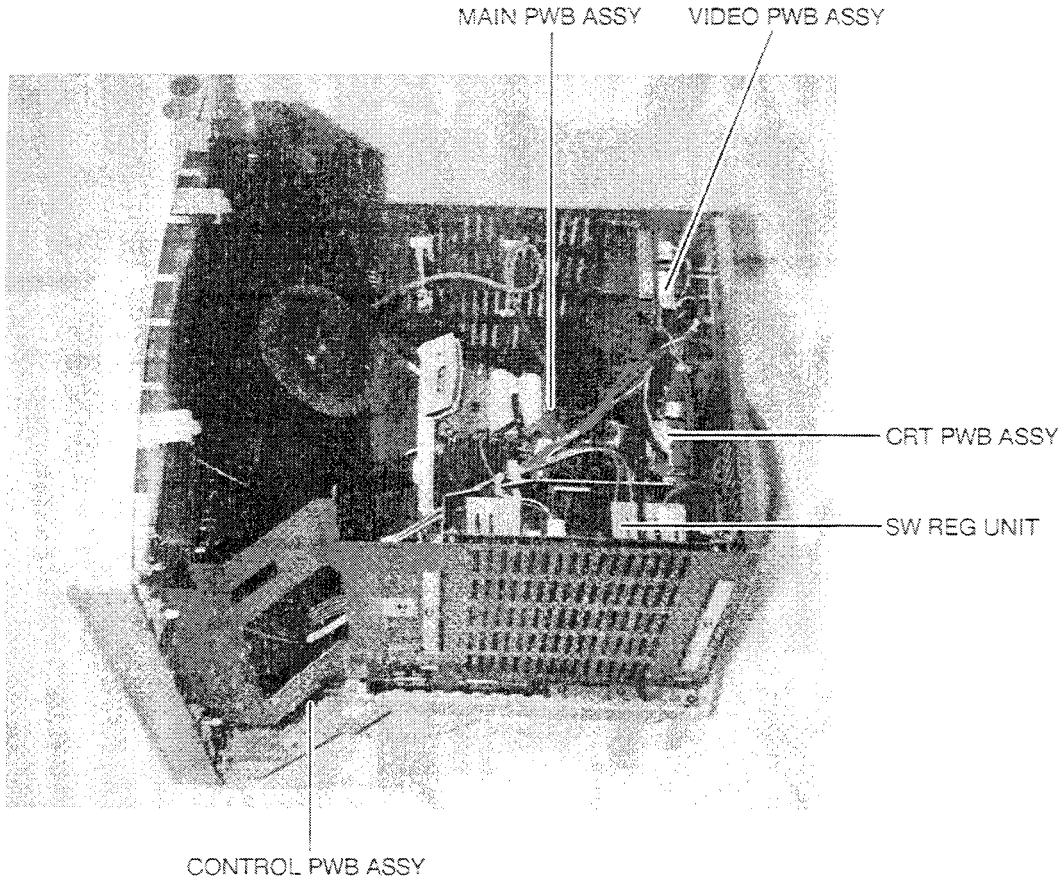



1. Disconnect the connectors "CN-K", "CN-Z", "CN-D/C" and "CN-SW".

2. Remove the two screws "H" and lift up the SW REG UNIT.

# BOARD LAYOUT

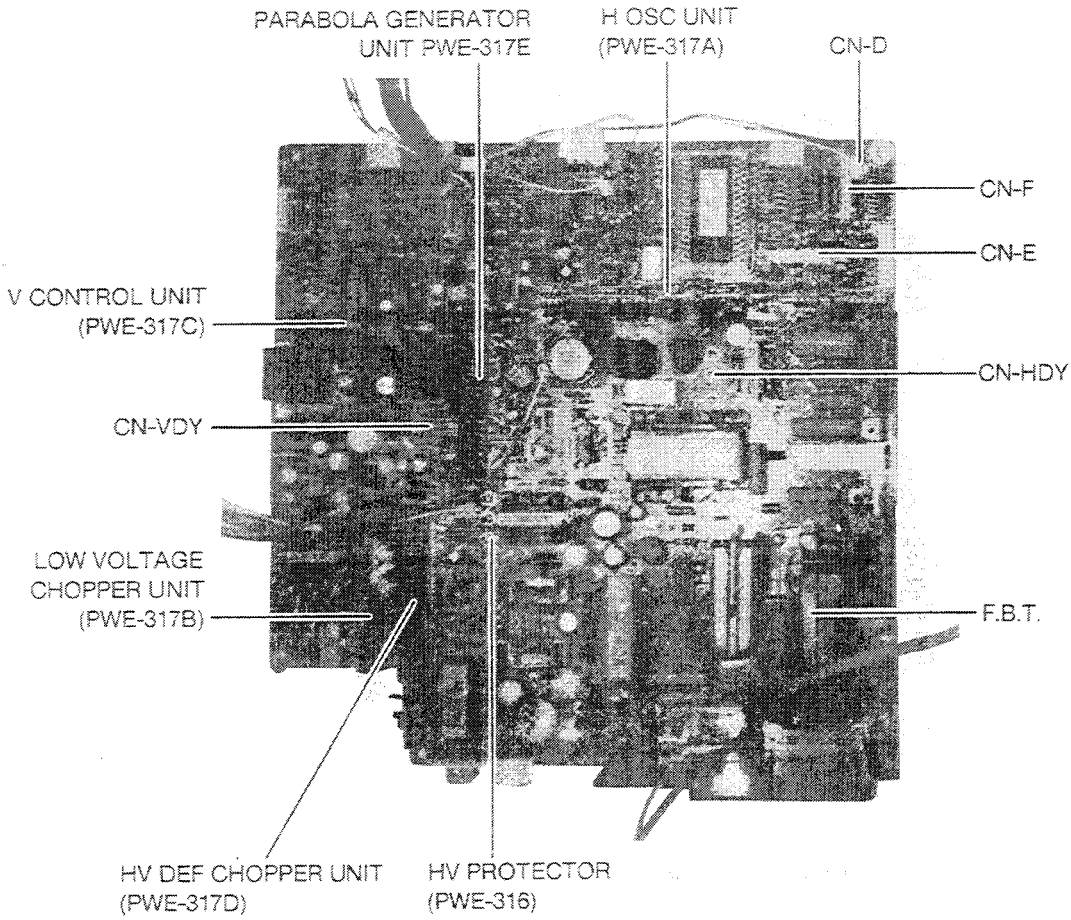
## PARTS LOCATION BOARD LAYOUT



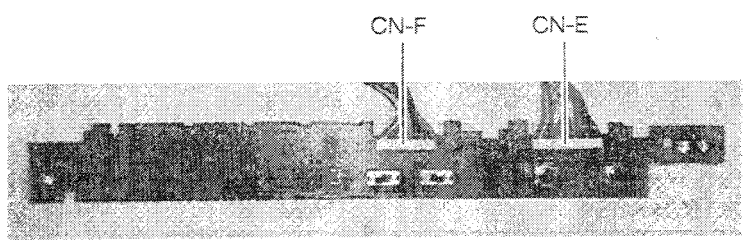

### BOARDS

| | |
|---|---|
| MAIN PWB ASSY | PWE-314 |
| VIDEO PWB ASSY | PWE-315A |
| CRT PWB ASSY | PWE-315B |
| SW REG UNIT | — |
| CONTROL PWB ASSY | PWE-318 |

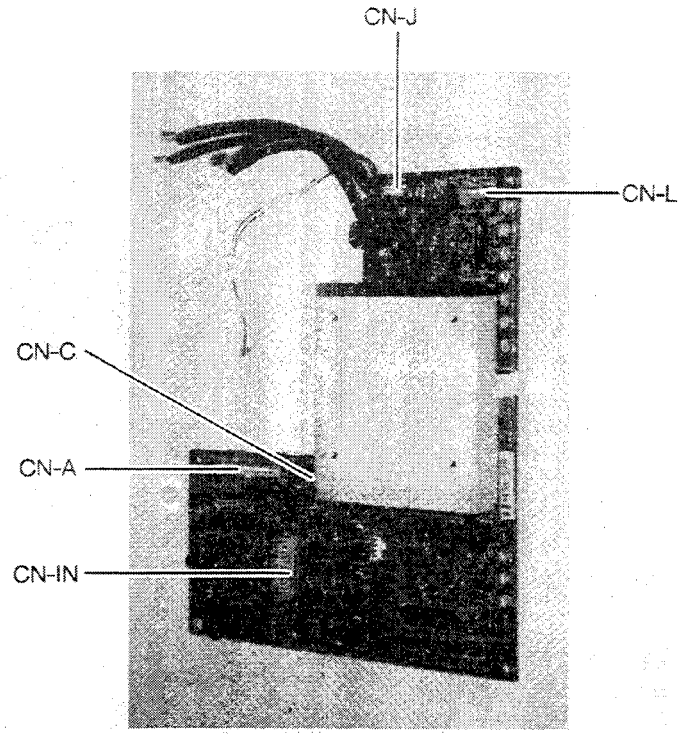
# CONNECTORS



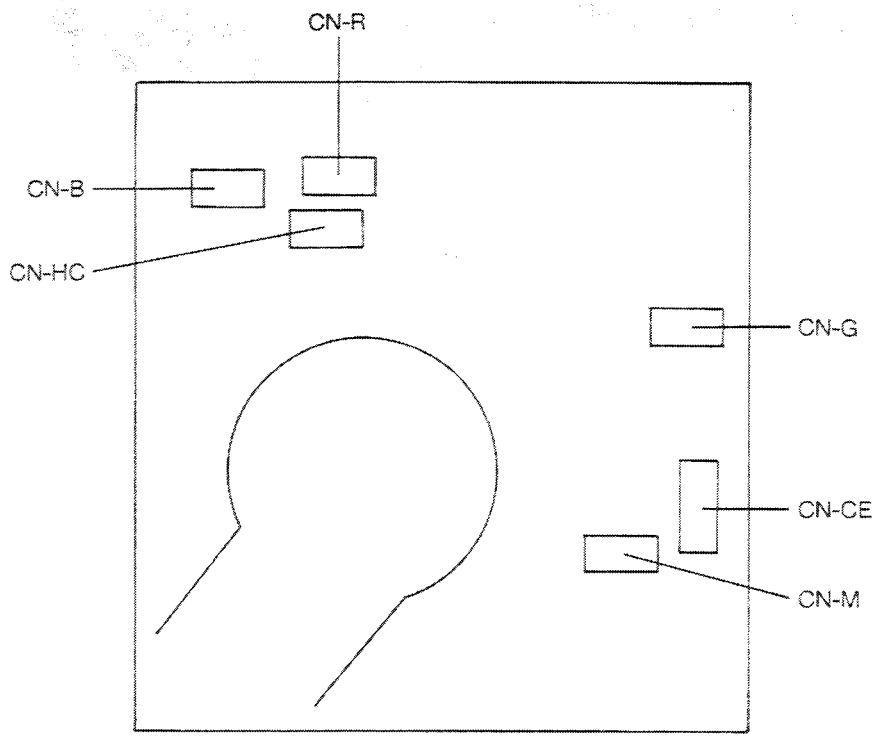

**MAIN PWB ASSY (PWE-314)**



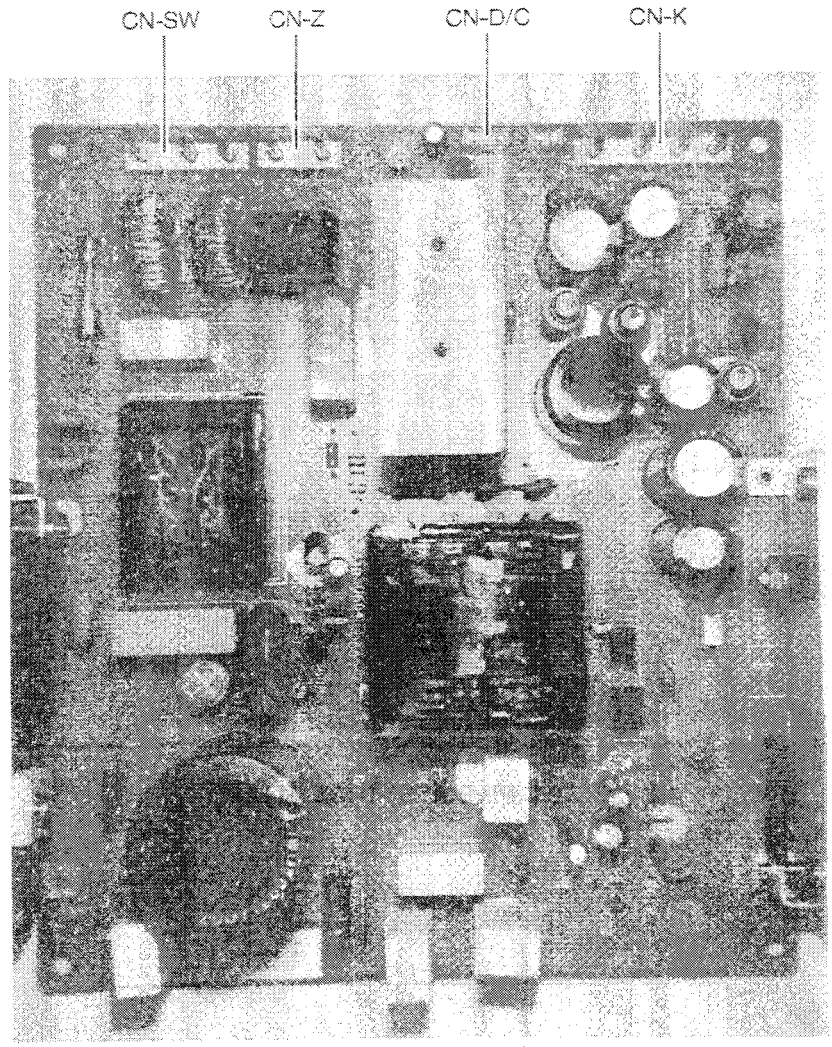

**CONTROL PWB ASSY (PWE-318)**




**VIDEO PWB ASSY (PWE-315A)**

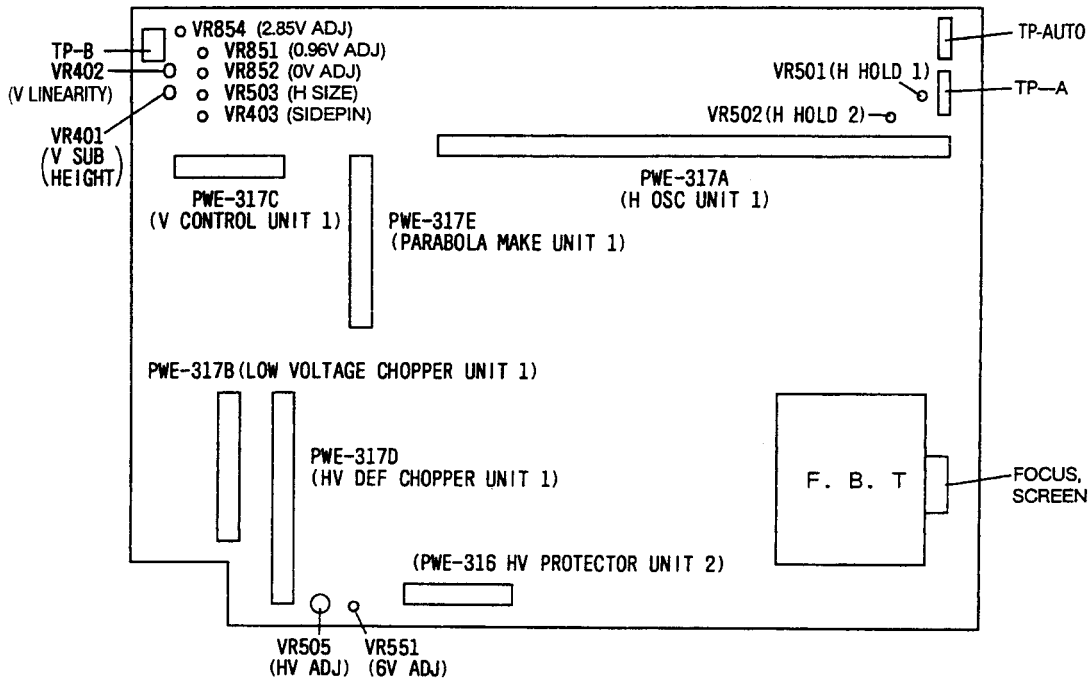



**CRT PWB ASSY (PWE-315B)**




**SW REG UNIT**

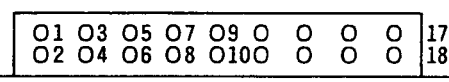
# ADJUSTMENT CONTROLS LAYOUT




MAIN PWB ASSY (PWE-314)

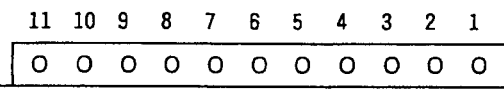
TEST PIN ASSIGNMENT

TP-AUTO



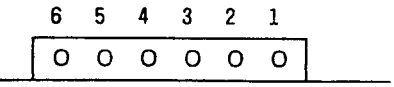

| PIN NO | | | |
|---|---|---|---|
| 1 | MEMORY RECALL | 10 | N C |
| 2 | AUTO ADJUSTMENT PULSE OUT | 11 | CONTROL DOWN |
| 3 | CONTROL SELECT 0(H S) | 12 | USER LEVEL ID |
| 4 | TEST POINT TP-3 | 13 | CONTROL UP |
| 5 | CONTROL SELECT 1(H P) | 14 | COLOR N |
| 6 | TEST POINT TP-2 | 15 | + 5v |
| 7 | CONTROL SELECT 2(V S) | 16 | COLOR 1 |
| 8 | TEST POINT TP-1 | 17 | GND |
| 9 | CONTROL SELECT 3(V P) | 18 | COLOR 2 |

TP-A

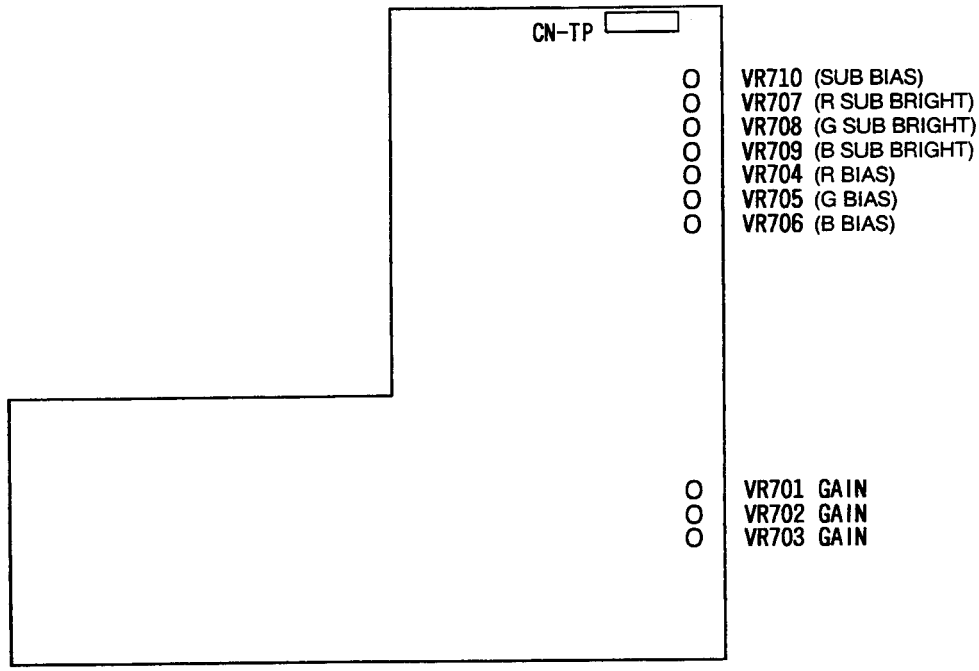



| PIN NO | | | |
|---|---|---|---|
| 1 | TEST POINT TP-1 | 7 | H V PROTECTOR (10) |
| 2 | TEST POINT TP-2 | 8 | H V PROTECTOR (8) |
| 3 | + 5v | 9 | H SYNC OFF |
| 4 | TEST POINT TP-3 | 10 | 0v ADJ |
| 5 | H V PROTECTOR (9) | 11 | GND |
| 6 | H V PROTECTOR (7) | | |

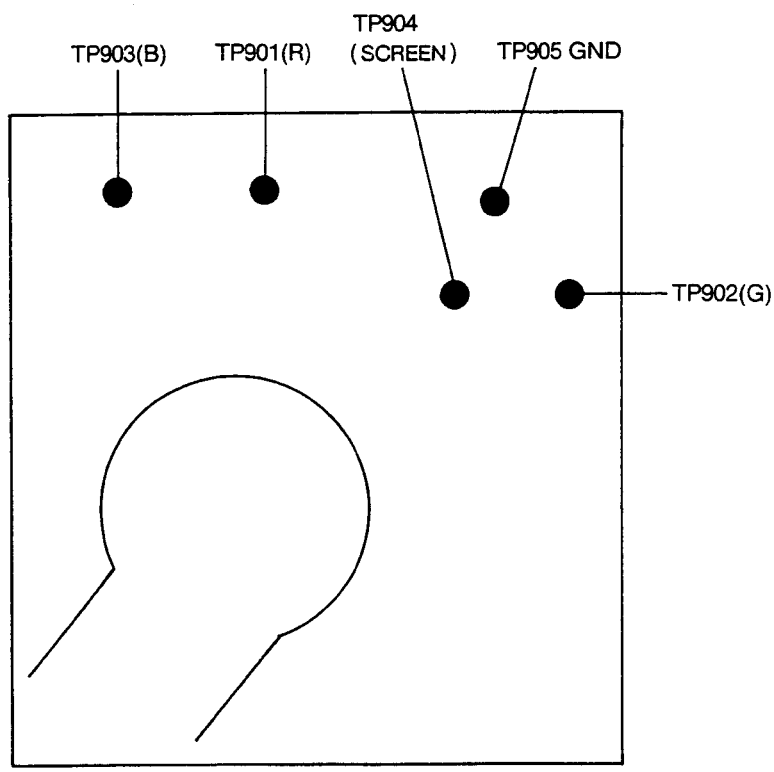
TP-B




| PIN NO | | | |
|---|---|---|---|
| 1 | GND | 4 | 0.96v ADJ |
| 2 | 2.85v ADJ | 5 | CUT OFF (NO VERTICAL HEIGHT) |
| 3 | 5.14v ADJ | 6 | CUT OFF (FINE ADJUST) |




**VIDEO PWB ASSY (PWE-315A)**




**CRT PWB ASSY (PWE-315B)**

# ADJUSTSMENT PROCEDURE

See page 91 and 92 for jig.

## Standard Adjustment Conditions

1) Power source voltage: JC-1531VMA AC120V, 60Hz /JC-1531VMB, R, B (EE) AC220V, 50Hz
2) Warm up: Adjust after leaving power on for a minimum twenty minutes.
3) Signal:

| | |
|---|---|
| Video: | Analog 0.7Vp-p 75 terminal positive polarity |
| | Analog sync on green |
| | Video: 0.7Vp-p |
| | Synchronizing: 0.3Vp-p |
| Sync: | TTL level Negative/positive polarity |
| | Separate/composite |
| Deflection frequency: | H 27kHz~57kHz |
| | V 55Hz~90Hz |

### 1. Pre-Adjustment of MAIN PWB

**NOTE:** The following 5 steps are to be performed only when the main PWB is replaced.

1) VR Settings
   VR501 H.HOLD 1 : Fully clockwise
   VR502 H.HOLD 2 : Fully clockwise
   VR503 H.SIZE : Fully counterclock wise
2) Heater Voltage Adjustment — Signal 9
   a) Receive the charactor "H".
   b) Supply 24V to MAIN PWB.
   c) Adjust VR551 so that the voltage across HC① and ② is 6.05V ±0.05V.
3) High Voltage Adjustment — Signal 11
   a) Connect CNP-HV.
   b) Turn VR505 (H.V.ADJ.VR) fully clockwise.
   c) Receive a crosshatched pattern and adjust VR501 (H.HOLD 1) and VR502 (H.HOLD 2) to sychronize the screen.
   d) Brightness control : Fully counterclockwise
      Contrast control : Fully counterclockwise
   e) Receive all-black signal.
   f) Confirm that the CRT is at cut-off.
   g) Adjust VR505 so that high voltage is 24kV ±0.1kV.
   h) Seal VR505 by using a cap (74102801) and silicon glue.
4) Reference Voltage Adjustment
   a) Supply 24V to MAIN PWB.
   b) Adjust VR851 (0.96V ADJ.) so that the voltage across TP42 and GND on Adjustment-PWB (TP-B ①and ④) 0.96V ±0.01V.
5) 0V Adjust — Signal 10
   a) Receive signal 10 (all "H").
   b) Adjust VR852 (5.14V ADJ) so that the voltage across TP-A ⑩ and ⑪ is 0V ±0.05V.

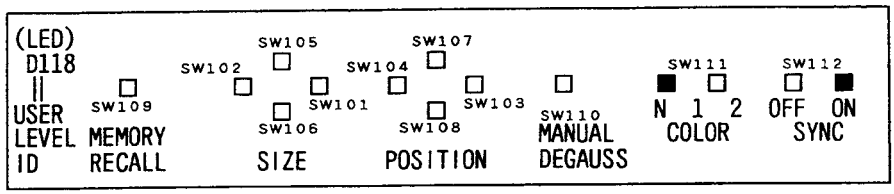
## 2. Main Adjustment

See page 91 and 92 for jig.

Service adjustments

* Set the user switch positions as follows unless otherwise instructed.

CONTRAST VR : Fully clockwise
BRIGHTNESS VR : Adjust to the point where the back raster just disappears
COLOR SW : Leftmost position (position "N")
SYNC SW : Left side (OFF)




Switch inside the front door

* The user level 1 LED indicaters the level as follows

LEVEL 1 : Turn off
LEVEL 2 : Turn on
LEVEL 3 : Turn on and off

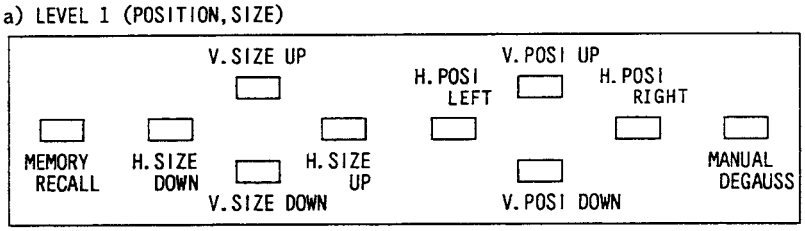
Unless otherwise instructed, set the user level to level 1.

* Changing the user level

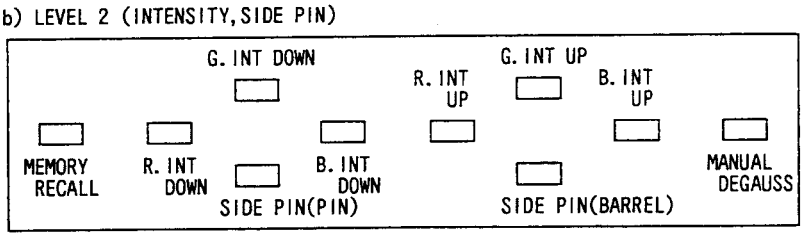
TO LEVEL 1 : Simultaneously press DEGAUSS (SW110) and V.POSI UP (SW107)
TO LEVEL 2 : Simultaneously press DEGAUSS (SW110) and H.POSI RIGHT (SW103)
TO LEVEL 3 : Simultaneously press DEGAUSS (SW110) and V.POSI DOWN (SW108)

*User switch functions

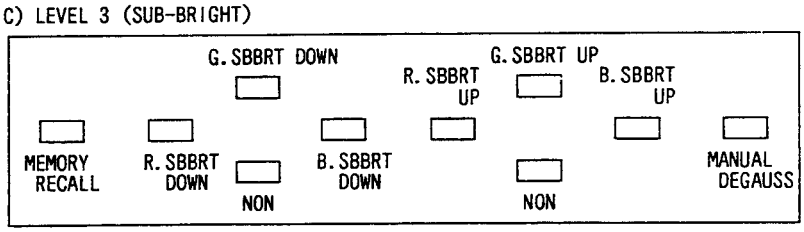
a) LEVEL 1 (POSITION, SIZE)




b) LEVEL 2 (INTENSITY, SIDE PIN)




C) LEVEL 3 (SUB-BRIGHT)




*Adjustment jig

Set all switches at "Open" position.
Connect TP-A and TP-B to Adjustment jig.

(2-1) MAIN PWB ADJUSTMENT

**See page 91 and 92 for jig.**

(1) Horizontal Hold — Signal 10, 12

(a) Receive signal 10 (all "H").
(b) Adjust VR852 (5.14VADJ) so that the voltage across TP43 and GND on Adjustment jig (TP-A⑩ and ⑪) is 0V±0.05V.
(c) Short SW46 on Adjustment jig (TP-A⑨ and ⑪) and adjust VR501 (H.HOLD 1) so that there is one screen.
(d) Open SW46 on Adjustment jig (TP-A⑨ and ⑪) and check for synchronization.
(e) Receive signal 12 (all "H").
(f) Short SW46 on Adjustment jig (TP-A⑨ and ⑪) and adjust VR502 (H.HOLD) so that there one screen.
(g) Open SW46 on Adjustment jig (TP-A⑨ and ⑪) and check for synchronization.

(2) Horizontal Raster Centering — Signal 12

(a) Receive all-black signal.
(b) If necessary, adjust the brightness control so that the raster is faintly illuminated.
(c) If necessary, press the user control switch (SW101) and compress the amplitude until both edges of the horizontal raster can be seen. (Adjust the HORIZONTAL RASTER size about 270mm)
(d) Adjust VR552 until the raster is centered on the screen.

(3) Vertical Linearity — Signal 6

Perform this procedure only necessary. If needed:
(a) Receive a crosshatch pattern.
(b) Adjust VR401 (V.SUB. HEIGHT) so that the vertical screen size is approximately 195mm.
(c) Adjust VR402 (V.LIN) to obtain the best vertical linearity.

(4) Vertical Sub Height — Signal 1

(a) Receive a crosshatch pattern.
(b) Adjust the user control V.POSI switches (SW107/108) to center the Vertical screen position.
(c) Use the V.SIZE switches (SW105/106) to increase the vertical screen size to the maximum size.
(d) Adjust VR401 (V.SUB. HEIGHT) so that the top and bottom horizontal lines of the crosshatch pattern just meet the front bezel.

(5) Side Pin — Signal 6

(a) Receive a crosshatch pattern (with outside border).
(b) Adjust the user control switches (SW101, 102, 105, and 106) to obtain the following picture size.
Vertical : approx. 195mm
Horizontal : approx. 260mm
(c) Short SW43 on Adjustment jig. (TP-A③ and ④)
(d) Push MEMORY RECALL SWITCH (SW109) for at least 2 seconds.
(e) Release the short.
(f) Adjust VR403 so that the vertical lines at left and right edges of the screen are straight.

(6) Horizontal Width — Signal 9

(a) Receive a crosshatch pattern.
(b) Adjust the brightness control so that the raster is faintly illumniated.
(c) Adjust the H.POSI SWITCHS (SW103/104) to center the horizintal screen position in the raster. If needed, decrease the horizontal size to center the screen position within the raster.
(d) Use the H. SIZE SWITCH (SW101) to increase the horizontal screen size to the maximum size.
(e) Adjust VR503 (H.SIZE) so that the rightmost and leftmost vertical line of the crosshatch pattern just meet the front bezel.

(7) Screen Position, Size, Side Pin Cushion, Digital control **See page 91 and 92 for jig.**

(7-1) Screen position and size signal 1, 2, 3, 4, 5, 6, 7, 8, 9

* Independent adjustments of each signal

(a) For signals 1 to 9, check that the screen position and size fall within the following limits.

Screen Size Horizontal: 260mm ±2mm
Vertical : 195mm ±2mm
Screen Position Space between bezel picture edge
Top and bottom space difference : ±2mm
Right and left space difference : ±2 mm

If the screen position and/or size does not fall within the above limits, carry out the following readjustment procedure.

(b) Receive a crosshatch pattern (with border) of the signal in question.
(c) Short SW41 and SW42 on Adjustment jig. (TP-A ①, ② and ③)
(b) Adjust the screen position and size to within the limits listed bove using the user control switches (SW101~108).
(e) Push MEMORY RECALL SWITCH (SW109) for at least 2 seconds.
(f) If more than one signal requires readjustment, repeat steps (b) through (e).
(g) Release the short.

(7-2) Side Pin Cushion signal 1, 6, 8, 9

* Repeat the following procedure for each of the 4 signals.

(a) Receive a crosshatch pattern.
(b) Check to if the side pin cushion distortion is within ±1.0mm.
If readjustment is necessary, carry out the following adjustment procedure starting with step (c).
If no readjustment is required, check the next signal.
(c) Short SW41 on Adjustment jig. (TP-A① and ③)
(d) Switch level 2 and check that the user level LED lights.
(e) Adjust V.SIZE DOWN (SW106) and V.POSI DOWN (SW108) so that the vertical lines on both sides of the screen image are straight.
(f) Return to level 1.
(g) Release the short.

(8) Video Amplitude

*Check to make sure the video input signal is set at the following level.

VIDEO : Analog 0.7Vp-p ±0.02V (75 ±1% terminal)

(8-1) Writing the Color Adjustment Reference Value signal 13

(a) Receive signal.
(b) Short SW42 on Adjustment jig. (TP-A② and ③)
(c) Push MEMORY RECALL SWITCH (SW109) for at least 2 seconds.
(d) Release the short.

(8-2) Initial Settings of Adjustment VRs

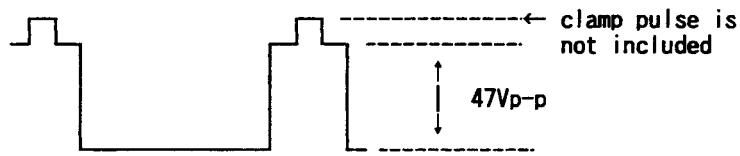
VR701~703 GAIN VR : Fully counterclockwise
VR704~706 BIAS VR : Fully counterclockwise
VR707~709 SUB BRIGHT VR : Fully counterclockwise
SCREEN VR : Fully counterclockwise
VR 710 SUB BIAS VR : Fully counterclockwise

(8-3) Attenuator control voltage signal 13 **See page 91 and 92 for jig.**

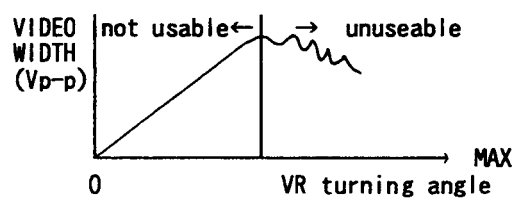
(a) Receive the window pattern.
(b) Turn the contrast control fully clockwise.
(c) Adjust VR854 so that the voltage across TP41 on Adjustment jig (TP-B① and ②) is 2.85V ±03V.

(8-4) Gain adjustment signal 13

(a) Receive the window pattern.
(b) Turn the contrast control fully clockwise.
Turn the brightness control fully cunterclockwise.
(c) Adjust VR701(R), VR702(G), VR703(B) so that the terminals TP901(R), TP902(G) and TP903(B) on the CRT PWB are each set to 47Vp-p (±1V or less). (Not including the clamp pulse.)
If it is not possible to obtain a voltage of 47Vp-p, readjust VR854 so that the R, G or B signal having the smallest wave height is set to 47Vp-p. Then adjust the other two color signals to 47Vp-p by turning the GAIN VR counterclockwise.
(d) After adjusting, check the amplitude of TP901(R), TP902(G) and TP903(B). If the settings are not correct, readjust.




**NOTE:**
Since the waveform will oscillate if the GAIN VR is used near the MAX position, start with the VR near the minimum amplitude position and adjust gradually until 47Vp-p is reached. Do not turn the VR to a position where the waveform oscillates. If it is not possible to obtain a voltage of 47Vp-p within the usable range, adjust the VR of the R, G or B signal with the smallest amplitude to the point closest to 47Vp-p within the usable range. Then adjust VR854 to 47Vp-p.



(9) Cut-off adjustment Signal 3 **See page 91 and 92 for jig.**

(a) Initial settings of the adjustment VRs

| | |
|---|---|
| VR704~VR706 BIAS VR : | Fully counterclockwise |
| VR707~VR709 SUB BRIGHT VR : | Fully counterclockwise |
| SCREEN VR : | Fully counterclockwise |
| VR710 SUB BIAS VR : | Fully counterclockwise |
| CONTRAST CONTROL : | Fully counterclockwise |
| BRIGHTNESS CONTROL : | Fully counterclockwise |

(b) Receive all-black signal.

(c) Short CN-TP ①, ②, ③ and ④. (Use CN-TP on Adjustment jig)
Short SW45 on Adjustment jig. (TP-B ① and ⑤)

(d) Connect a high voltage meter to TP904 and adjust the SCREEN VR so thatthe voltage is 470Vdc ±5Vdc. (Use a voltmeter with a maximum voltage capacity of 1.5kV or greater and an input resistance of 1000megaohms or greater.)

(e) As VR710 (SUB BIAS VR) is gradually turned clockwise, a single color will appear as a horizontal line. This color is the reference color for the cut-off adjustment. If the reference color does not appear with VR710 turned fully clockwise, turn VR705 clockwise until the green horizontal line faintly appears. Use this as your reference color then adjust VR704 and VR706 to form a white line.

(f) Turn the bias VRs for the other two colors (other than the reference color) to form a white line.

(g) Open the short SW45 on Adjustment jig. (TP-B ① and ⑤)

**NOTE:**

White tracking will be best at dark cut-off adjustment settings. For the best setting, therefore, perform the cut-off adjustment in as dark a place as possible.

(10) Cut-off Fine Adjustment (Contrast Tracking) (signal 13)

(a) Receive the window pattern.

(b) Shorted SW44 on Adjustment jig. (TP-B ① and ⑥)

(c) Leave CN-TP ①, ②, ③ and ④ short.

(d) Turn the contrast control fully clockwise (MAX) and measure the color temperature (X1, Y2).

(e) Turn the contrast control fully counterclockwise (MIN) and measure the color temperature (X2, Y2). Finely adjust the BIAS VRs of the colors other than the cut-off reference color so that (X1, Y1)=(X2, Y2).
If this adjustment is difficult, try finely adjusting the BIAS VR of the reference color.

(f) Turn the contrast control again fully clockwise (MAX) and measure the color temperature. If thecolor temperature has shifted, repeat the fine adjustment procedure in step (e).

$\Delta X = X1 - X2 \geqq 0.005$

$\Delta X = Y1 - Y2 \geqq 0.005$

(g) Remove the shorts between CN-TP ①, ②, ③ and ④.

(11) SUB-BRIGHT Ajustment Signal 3, 13 **See page 91 and 92 for jig.**

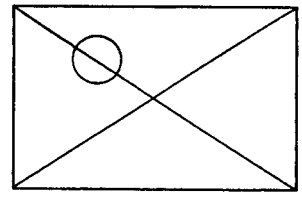
(a) Short SW44 on Adjustment jig. (TP-B ① and ⑥)
(b) Receive all-black signal of signal 3. Turn the contrast control fully clockwise.
(c) Adjust VR708 clockwise to obtain 6cd/cm$^2$ ±0.5 (using an analyzer).
(d) Receive the window pattern of signal 13. Set Y=Y1 ±0.005 using VR709.
(e) Set X=X1 ±0.005 using VR707.
(f) Repeat steps (d) and (e) until the following settings are achieved.
Y=Y1 ±0.005
X=X1 ±0.005
(X1 and Y1 are the values measured in step (d) of procedure (10).)
(g) Remove the short between SW44 on Adjustment jig. (TP-B ① and ⑥)

(12) Color Mode Color Temperature

(a) Initial setting of the adjustment VRs.
CONTRAST control : Fully clockwise
BRIGHT control : Fully counterclockwise
COLOR SW position : N (leftmost position)
(b) Receive signal 13.
(c) Short CN-TP ①, ②, ③ and 4. (use CN-TP on Adjustment jig)
(d) Switch to level 2 annd confirm that the LED lights.
(e) Short SW42 on Adjustment jig. (TP-A ② and ③)
(f) Use the user controls to adjust the color temperature to:
X=0.300 ±0.003
Y=0.305 ±0.003
(g) Push MEMORY RECALL SWITCH (SW109) for at least 2 seconds.
(h) Release the short CN-TP ①, ②, ③ and 4.
(i) Receive all-black signal of signal 3.
(j) Turn the brightness control fully clockwise.
(k) Switch to level 3 and confirm that the LED turns on and off.
(l) Use the user controls to adjust the color temperature to:
X=0.300 ±0.005
Y=0.305 ±0.005
(m) Push MEMORY RECALL SWITCH (SW109) for at least 2 seconds.
(n) Remove the short SW42 on Adjustment jig. (TP-A ② and ③)
(o) Receive all-black signal of signal 3.
(p) Set the color switch to 1 (middle position).
(q) Switch to level 2 and confirm that the LED turns on and off.
(r) Push MEMORY RECALL SWITCH (SW109).
(s) Set the color switch to 2 (right position).
(t) Push MEMORY RECALL SWITCH (SW109).
(u) Return to level 1 and confirm that the user level LED is extinguished.
(v) Set the color switch to N (left position).

(13) Focus Adjust signal 7

(a) Turn the contrast control clockwise. Turn the brightness control to the point where the raster just disappears.
(b) Receive the "$" character with 4 dots missing.
(c) Adjust the F.B.T focus VR to achieve the best focus at an intermediate point between the center of the screen and the corner (circled area in diagram below).



(14) SET the user switch

CONTRAST VR : Fully clockwise
BRIGHTNESS VR : Fully clockwise
COLOR SW : Left most position (position "N")
SYNC : Left side (OFF)

(15) Adjustment Signal and Timing

Adjustment signals and Timing (Nos.1~9 : Preset signals)

| No. | Signal | SYNC | Sync Polarity horizontal | Sync Polarity vertical | |
|---|---|---|---|---|---|
| 1 | VGA 350 | SEPARATE | positive | negative | |
| 2 | VGA 400 | SEPARATE | negative | positive | |
| 3 | VGA 480 | SEPARATE | negative | negative | |
| 4 | 8514A | SEPARATE | positive | positive | interlace |
| 5 | MAC-II | SYNC ON GREEN | —— | —— | ※1 |
| 6 | 800x600(56) | SEPARATE | positive | positive | The sync polarity can also be negative |
| 7 | 800x600(72) | SEPARATE | positive | positive | |
| 8 | 1024x768(60) | SEPARATE | negative | negative | |
| 9 | 1024x768(70) | SEPARATE | negative | negative | |
| 10 | H.HOLD 1 | SEPARATE | | | Fh=27KHz/Fv=55Hz |
| 11 | HV.ADJ | SEPARATE | | | Fh=42.5KHz/Fv=70Hz |
| 12 | H.HOLD 2 | SEPARATE | | | Fh=57KHz/Fv=90Hz |
| 13 | WINDOW(VGA480) | SEPARATE | negative | negative | VGA 480 ※2 |
| 14 | EVGA 480 | SEPARATE | negative | negative | |

※1 When SYNC On GREEN output,simultaneously output a COMPOSITE SYNC signal to the H.SYNC line. V.SYNC connect to ground.
COMPOSIT SYNC polarity is NEG/NEG

※2 Video Horizontal size 1/8 of width
Vertical size 1/4 of height

※3 Crosshatch Vertical lines:17
Horizontal lines:13

※4 If the condition of the signal generator makes it impossible to output signals with an Fh of exactly 27.00kHz 56kHz,use the following

27kHz : Largest value ≦ 27.00kHz (EX: 26.99)

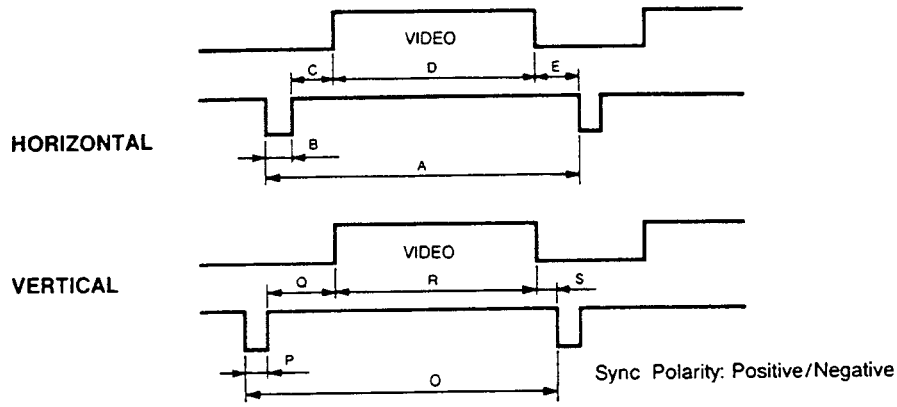
57kHz : Smallest value ≧ 57.00kHz (EX: 57.01)

PRESET TIMING

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VGA350 | VGA400 | VGA480 | 8514/A | MAC II | 800x600 (56) | 800x600 (72) | 1024 x768(60) | 1024 x768(70) | 27K | 42.5K | 57K | 640x480 (72) |
| fh(KHz) | 31.47 | 31.47 | 31.47 | 35.52 | 35 | 35.16 | 48.09 | 48.363 | 56.476 | 27 | 42.5 | 57 | 37.86 |
| A(us)<br>(DOTS) | 31.78<br>900 | 31.78<br>900 | 31.78<br>900 | 28.15<br>1264 | 28.57<br>864 | 28.44<br>1025 | 20.79<br>1040 | 20.677<br>1344 | 17.707<br>1328 | 37.04 | 23.53 | 17.54 | 26.413<br>832 |
| B(us)<br>(DOTS) | 3.81<br>108 | 3.81<br>108 | 3.81<br>108 | 3.92<br>176 | 2.12<br>64 | 2<br>72 | 2,399<br>120 | 2.09<br>136 | 1.813<br>136 | 4.4 | 2.715 | 1.9 | 1.27<br>40 |
| C(us)<br>(DOTS) | 1.91<br>54 | 1.91<br>54 | 1.91<br>54 | 1.25<br>56 | 3.17<br>96 | 3.56<br>128 | 1,279<br>64 | 2.46<br>160 | 1.92<br>144 | 2.2 | 1.448 | 2.1 | 4,063<br>128 |
| D(us)<br>(DOTS) | 25.42<br>720 | 25.42<br>720 | 25.42<br>720 | 22.8<br>1024 | 21.16<br>640 | 22.22<br>800 | 15.995<br>800 | 15.75<br>1024 | 13.653<br>1024 | 29.63 | 18.1 | 13.15 | 20.317<br>640 |
| E(us)<br>(DOTS) | 0.64<br>18 | 0.64<br>18 | 0.64<br>18 | 0.18<br>8 | 2.12<br>64 | 0.67<br>24 | 1.119<br>56 | 0/369<br>24 | 0.32<br>24 | 0.81 | 1.26 | 0.39 | 0.762<br>24 |
| | | | | | | | | | | | | | |
| fv(hz) | 70.09 | 70.09 | 59.94 | 86.96 | 66.67 | 56.25 | 72.01 | 60.004 | 70.069 | 55.0 | 70 | 90 | 72.809 |
| O(ms)<br>(LINE) | 14.27<br>449 | 14.27<br>449 | 16.68<br>525 | 11.5<br>408.5 | 15<br>525 | 17.78<br>625 | 13.887<br>666 | 16.666<br>806 | 14.272<br>806 | 18.18<br>491 | 14.29<br>607 | 11.11<br>633 | 13.735<br>520 |
| P(ms)<br>(LINE) | 0.06<br>2 | 0.06<br>2 | 0.06<br>2 | 0.113<br>4 | 0.09<br>3 | 0.06<br>2 | 0.124<br>6 | 0.124<br>6 | 0.106<br>6 | 0.07<br>2 | 0.141<br>6 | 0.105<br>6 | 0.079<br>3 |
| Q(ms)<br><br>(LINE) | 1.91<br><br>60 | 1.11<br><br>35 | 1.05<br><br>33 | $\frac{0.563}{0.577}$<br><br>$\frac{20}{20.5}$ | 1.11<br><br>39 | 0.63<br><br>22 | 0.479<br>23 | 0.6<br>29 | 0.513<br>29 | 1.29<br>35 | 0.54 | 0.527<br>30 | 0.74<br>28 |
| R(ms)<br>(LINE) | 11.12<br>350 | 12.71<br>400 | 15.25<br>480 | 10.81<br>384 | 13.71<br>480 | 17.07<br>600 | 12.51<br>600 | 15.88<br>768 | 13.599<br>768 | 14.81<br>400 | 12.95<br>550 | 10<br>570 | 12.68<br>480 |
| S(ms)<br><br>(LINE) | 1.18<br><br>37 | 0.38<br><br>12 | 0.32<br><br>10 | 0<br>/0.014<br>0<br>/0.5 | 0.09<br><br>3 | 0.03<br><br>1 | 0.772<br>37 | 0.062<br>3 | 0.053<br>3 | 2.01 | 0.66 | 0.478 | 0.238<br>72 |
| | SEPARATE | SEPARATE | SEPARATE | SEPARATE | ★<br>COMPOSITE | SEPARATE | SEPARATE | SEPARATE | SEPARATE | SEPARATE | SEPARATE | SEPARATE | SEPARATE |
| | | | | | SYNC ON GREEN | | | | | | | | |
| H.SYNC | POS | NEG | NEG | POS | ★ NEG | POS | POS | NEG | NEG | POS | NEG | NEG | NEG |
| V.SYNC | NEG | POS | NEG | POS | ★ NEG | POS | POS | NEG | NEG | NEG | NEG | POS | NEG |
| | | | | INTER LACED | | | | | | NO-PRESET | NO-PRESET | NO-PRESET | NO-PRESET |

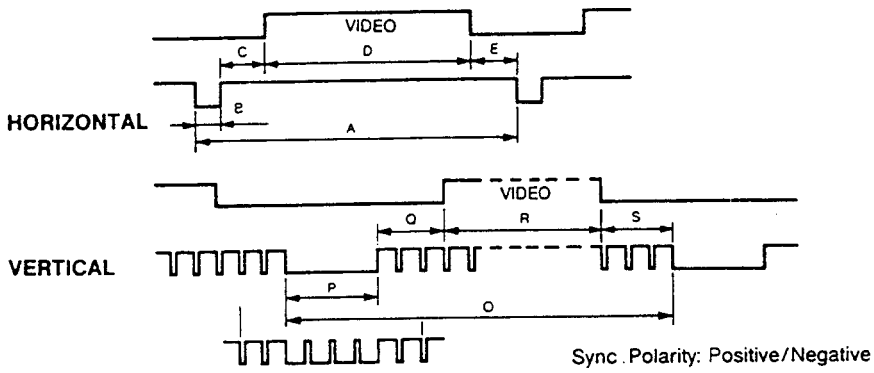
# Timing Charts

### SEPARATE SYNC.



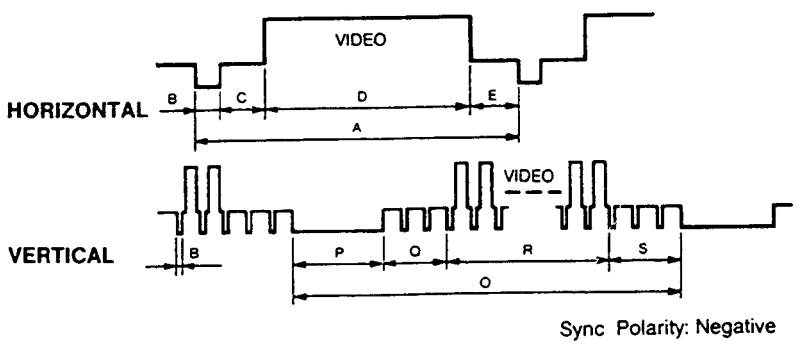

Sync Polarity: Positive/Negative

### COMPOSITE SYNC.




Sync . Polarity: Positive/Negative

### COMPOSITE SYNC AND VIDEO (SYNC ON GREEN)




Sync Polarity: Negative

**Timing of References Signals**
**Signal for Using LVG-1603**

| Abbreviation | | UNIT | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| | | | VGA 350 | VGA 400 | VGA 480 | 8514A | MACII | 800x 600 (56) |
| HORIZONTAL | Total | DOT | 0800 | 0900 | 0800 | 1264 | 0864 | 1024 |
| | Rate | kHz | 031470 | 031470 | 031470 | 035520 | 03500 | 035160 |
| | Dots/Character | DOT | 08 | 09 | 08 | 08 | 08 | 08 |
| | Character | CHR | F080 | F080 | F080 | F128 | F080 | F100 |
| | Drive Delay | DOT | 0656 | 0738 | 0656 | 1032 | 0704 | 0824 |
| | Drive Width | DOT | 0096 | 0108 | 0096 | 0176 | 0064 | 0072 |
| VERTICAL | Total | RASTER | 0449 | 0449 | 0524 | 0409 | 0525 | 0625 |
| | Rate | Hz | 070000 | 070000 | 060000 | 087000 | 066700 | 056200 |
| | Lines/Character | RASTER | 14 | 16 | 16 | 12 | 16 | 15 |
| | Rows | RASTER | 0350 | 0400 | 0480 | 0384 | 0480 | 0600 |
| | Drive Delay | RASTER | 0387 | 0412 | 0489 | 0384 | 0483 | 0601 |
| | Drive Width | RASTER | 0002 | 0002 | 0002 | 0004 | 0003 | 0002 |
| DOT RATE | | MHz | 025175 | 028323 | 025175 | 044897 | 030240 | 036004 |
| Scan Mode | | | F0 | F0 | F0 | F1 | F0 | F0 |
| Chracter Font | | | F1 | F1 | F1 | F1 | F1 | F1 |
| Chracter Code | | | - | - | - | - | - | - |
| Pattern Key Code | | | F | F | F | F | F | F |
| Video Output | | | 1110 | 1110 | 1110 | 1110 | 1110 | 1110 |
| Add Sync/Inverse | | | 0001 | 0001 | 0001 | 0001 | 0101 | 0001 |
| Dot Duty | | | 00 | 00 | 00 | 00 | 00 | 00 |
| Polarity | | | 10 | 01 | 00 | 11 | 00 | 11 |

| 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|
| 800x 600 (72) | 1024x 768 (60) | 1024x 768 (70) | 27kHz | 42.5 kHz | 57kHz | VGA480 WINDOW | 640x 480 (72) |
| 1040 | 1239 | 1062 | 0900 | 0900 | 0900 | 0900 | 0832 |
| 048100 | 048363 | 056476 | 027000 | 042500 | 057000 | 031466 | 037860 |
| 08 | 08 | 08 | 08 | 08 | 08 | 08 | 08 |
| F100 | F118 | F102 | F087 | F086 | F084 | F018 | F080 |
| 0856 | 0966 | 0838 | 0700 | 0740 | 0695 | 0450 | 0664 |
| 0120 | 0125 | 0109 | 0093 | 0104 | 0097 | 0108 | 0040 |
| 0668 | 0806 | 0806 | 0491 | 0900 | 0633 | 0525 | 0520 |
| 072006 | 060004 | 070064 | 054990 | 070016 | 090047 | 059935 | 072808 |
| 12 | 10 | 10 | 10 | 10 | 10 | 16 | 10 |
| 0602 | 0768 | 0768 | 0400 | 0550 | 0570 | 0120 | 0480 |
| 0639 | 0771 | 0771 | 0454 | 0578 | 0597 | 0310 | 0489 |
| 0006 | 0006 | 0006 | 0002 | 0006 | 0006 | 0002 | 0003 |
| 050024 | 059992 | 059978 | 024300 | 038250 | 051300 | 028319 | 031500 |
| F0 | F0 | F0 | F0 | F0 | F0 | F0 | F0 |
| F1 | F1 | F1 | F1 | F1 | F1 | F1 | F1 |
| - | - | - | - | - | - | - | - |
| F | F | F | F | F | F | F | F |
| 1110 | 1110 | 1110 | 1110 | 1110 | 1110 | 1110 | 1110 |
| 0001 | 0001 | 0001 | 0001 | 0001 | 0001 | 0001 | 0001 |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 11 | 00 | 00 | 10 | 00 | 01 | 00 | 00 |

**Timing of References Signals**
**Signal for Quantum 801C**

| | '01 | '02 | '03 | '04 | '05 |
|---|---|---|---|---|---|
| | VGA350 | VGA400 | VGA480 | 8514/A | MAC II |
| Dot Rate (MHz) | 25.175 | 28.320 | 27.175 | 31.968 | 30.240 |
| Horizontal Rate (kHz) | 31.470 | 31.467 | 31.467 | 35.520 | 35.000 |
| Vertical Rate (Hz) | 70.08 | 70.08 | 60.06 | 86.96 | 66.67 |
| | | | | | |
| H. Dots/Char | 8 | 9 | 8 | 9 | 8 |
| H. Total | 100 | 100 | 100 | 100 | 108 |
| H. Chracters | 80 | 80 | 80 | 81 | 80 |
| H. Drive Delay | 82 | 82 | 82 | 82 | 88 |
| H. Drive Width | 12 | 12 | 12 | 14 | 8 |
| | | | | | |
| V. Lines/Char | 10 | 10 | 10 | 12 | 10 |
| V. Total | 449 | 449 | 524 | 817 | 525 |
| V. Rows | 35 | 40 | 48 | 64 | 48 |
| V. Drive Delay | 39 | 41 | 49 | 64 | 48 |
| V. Drive Width | 2 | 2 | 2 | 4 | 3 |
| V. Step Width | 2 | 2 | 2 | 2 | 2 |
| | | | | | |
| OP 1. (Comp.Sync.) | 0 | 0 | 0 | 0 | 0 |
| OP 2. (V.Step) | 0 | 0 | 0 | 0 | 0 |
| OP 3. (H.Drive) | 1 | 1 | 1 | 1 | 1 |
| OP 4. (V.Drive) | 1 | 1 | 1 | 1 | 1 |
| OP 5. (Comp.Sync.P) | | | | | |
| OP 6. (V.Step.P) | 0 | 0 | 0 | 0 | 0 |
| OP 7. (H.Drive.P) | 0 | 1 | 1 | 0 | 1 |
| OP 8. (V.Drive.P) | 1 | 0 | 1 | 0 | 1 |
| OP 9. (Interrace) | 0 | 0 | 0 | 3 | 0 |
| OP 10. (Video Mode) | 1 | 1 | 1 | 1 | 1 |
| OP 11. (Duty Cycle) | 0 | 0 | 0 | 0 | 0 |
| OP 12. (Clock Phase) | 0 | 0 | 0 | 0 | 0 |
| OP 13. (Video.P) | 0 | 0 | 0 | 0 | 0 |
| OP 14. (H.Skew) | | | | | |
| OP 15. (V.Skew) | | | | | |
| OP 16. (Cursor) | | | | | |

| '06 | '07 | '08 | '09 | '10 | '11 | '12 |
|---|---|---|---|---|---|---|
| SVGA56 | SVGA72 | 10x7(60) | 10x7(72) | 27kHz | 42.5kHz | 57kHz |
| 31.960 | 32.016 | 32.112 | 30.936 | 24.304 | 31.952 | 32.144 |
| 35.160 | 48.072 | 48.361 | 56.659 | 27.004 | 42.489 | 56.993 |
| 56.26 | 78.18 | 59.85 | 70.04 | 55.00 | 70.00 | 90.04 |
| | | | | | | |
| 9 | 9 | 8 | 6 | 9 | 8 | 6 |
| 101 | 74 | 83 | 91 | 100 | 94 | 94 |
| 79 | 57 | 63 | 70 | 80 | 72 | 70 |
| 81 | 61 | 64 | 77 | 82 | 77 | 72 |
| 7 | 9 | 4 | 6 | 12 | 11 | 10 |
| | | | | | | |
| 10 | 12 | 12 | 8 | 10 | 10 | 8 |
| 625 | 666 | 808 | 809 | 491 | 607 | 633 |
| 60 | 50 | 64 | 96 | 40 | 55 | 71 |
| 60 | 53 | 64 | 96 | 45 | 58 | 75 |
| 2 | 6 | 4 | 2 | 5 | 6 | 6 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | 1 | 1 | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| '13 | '14 |
|---|---|
| WINDOW | EVGA480 |
| 28.320 | 31.496 |
| 31.467 | 37.856 |
| 60.06 | 72.80 |
| | |
| 9 | 8 |
| 100 | 104 |
| 32 | 80 |
| 58 | 83 |
| 12 | 5 |
| | |
| 10 | 12 |
| 524 | 520 |
| 18 | 40 |
| 34 | 41 |
| 2 | 3 |
| 2 | 2 |
| | |
| 0 | 0 |
| 0 | 0 |
| 1 | 1 |
| 1 | 1 |
| | |
| 0 | 0 |
| 1 | 1 |
| 1 | 1 |
| 0 | 0 |
| 1 | 1 |
| 0 | 0 |
| 0 | 0 |
| 0 | 0 |
| | |
| | |
| | |

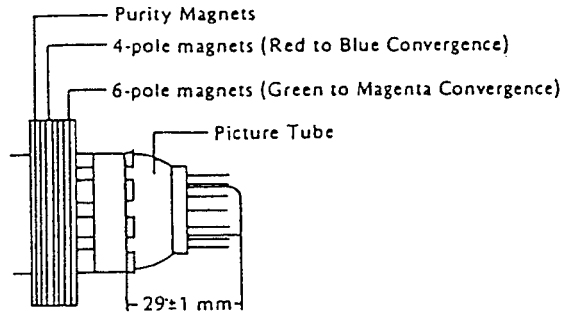
## Purity Adjustment

(1) Be sure that the display is not being exposed to any external magnetic fields.

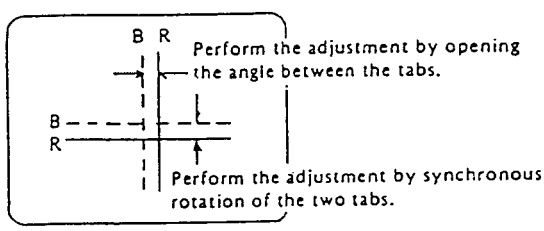
(2) Ensure that the spacing between the Purity Convergence Magnet (PCM) assembly and the CRT stem is 29 mm±1 mm. (See diagrams below)

(3) Produce a complete, red pattern on the screen. Adjust the purity magnet rings on the PCM assembly to obtain a complete field of the color red. This is done by moving the two tabs in such a manner that they advance in an opposite direction but at the same time to obtain the same angle between the two tabs, which should be approximately 180°.

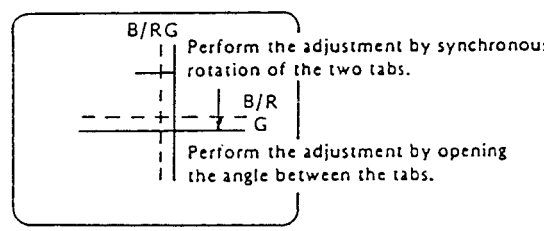
(4) Check the complete blue and complete green patterns to observe their respective color purity. Make minor adjustments if needed.




Purity, Convergence Magnet Assembly (PCM)


B R
Perform the adjustment by opening the angle between the tabs.
B
R
Perform the adjustment by synchronous rotation of the two tabs.

Red to Blue Convergence
(Magenta)


B/RG
Perform the adjustment by synchronous rotation of the two tabs.
B/R
G
Perform the adjustment by opening the angle between the tabs.

Green to Magenta Convergence
(White)

## 18. Convergence Adjustment

(1) Produce a magenta crosshatch on the screen.

(2) Adjust the focus for the best overall focus on the screen.
Also adjust the brightness to the desired condition.

(3) Vertical red and blue lines are converged by varying the angle between the two tabs of the 4-pole magnets on the PCM assembly. (See diagrams above)

(4) Horizontal red and blue lines are converged by varying the two tabs together, keeping the angle between them constant.

(5) Produce a white crosshach pattern on the screen.

(6) Vertical green and magenta lines are converged by varying the angle between the two tabs of the 6-pole magnets.

(7) Horizontal green and magenta lines are converged by varying the two tabs together, keeping the angle between them constant.

# CIRCUIT DESCRIPTION

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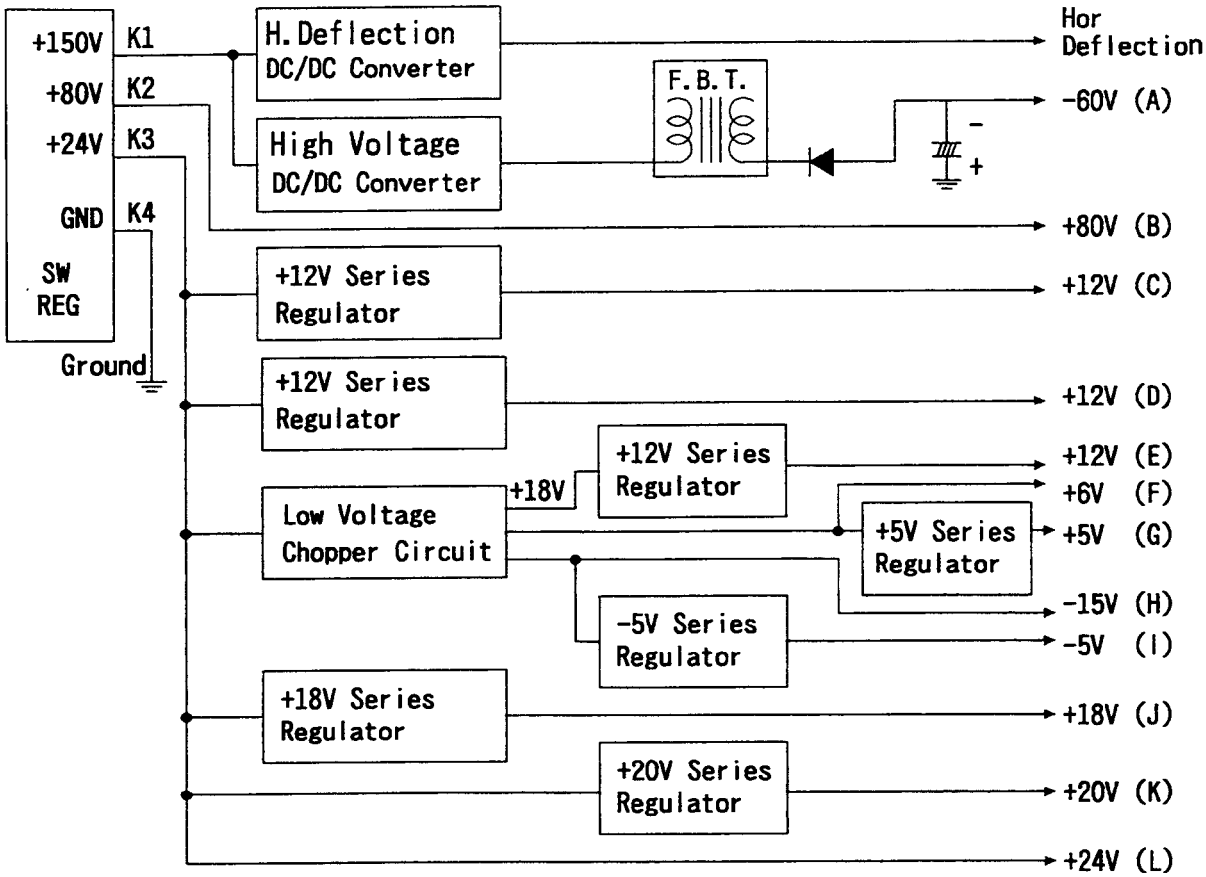
# CIRCUIT DESCRIPTION

## 1. Power Supply Circuit



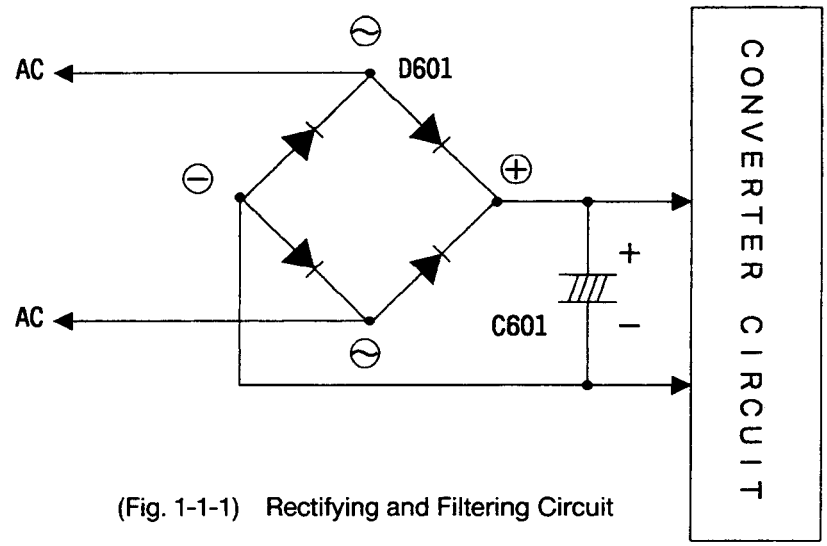

(Fig. 1-1) BLOCK DIAGRAM of the 4FG's Power Supply

(A) −60 V ⇒ SUB-BIAS CONTROL
(B) +80 V ⇒ VIDEO OUTPUT AMPLIFIER
(C) +12 V ⇒ D/A STARTUP CIRCUITS AND BRIGHTNESS/CONTROLS
(D) +12 V ⇒ D/A and OP-AMP IC SUPPLY VOLTAGE
(E) +12 V ⇒ VIDEO BOARD OP-AMP SUPPLY, VIDEO PRE-AMPLIFIER SUPPLY, and VERTICAL DEFLECTION OUPUT SUPPLY
(F) +6 V ⇒ CRT HEATER
(G) +5 V ⇒ CPU SUPPLY VOLTAGE
(H) −15 V ⇒ PARABOLA SUPPLY UNIT
(I) −5 V ⇒ HORIZONTAL OSCILLATION UNIT, PARABOLA UNIT, D/A OP-AMP OUTPUT SUPPLY VOLTAGE
(J) +18 V ⇒ PARABOLA UNIT and POWER INDICATOR LEDs
(K) +20 V ⇒ HIGH VOLTAGE and HORIZONTAL DEFLECTION UNIT
(L) +24 V ⇒ LOW VOLTAGE CHOPPER CONTROL UNIT, VERTICAL DEFLECTION SUPPLY, HORIZONTAL OSCILLATION UNIT and HIGH VOLTAGE PROTECTOR UNIT

## 1-1. Switching regulator unit

**(a) Rectifying and filtering circuit**

AC input is rectified by D601. Then, it is filtered by C601. The resulting DC voltage is supplied to the converter circuit.

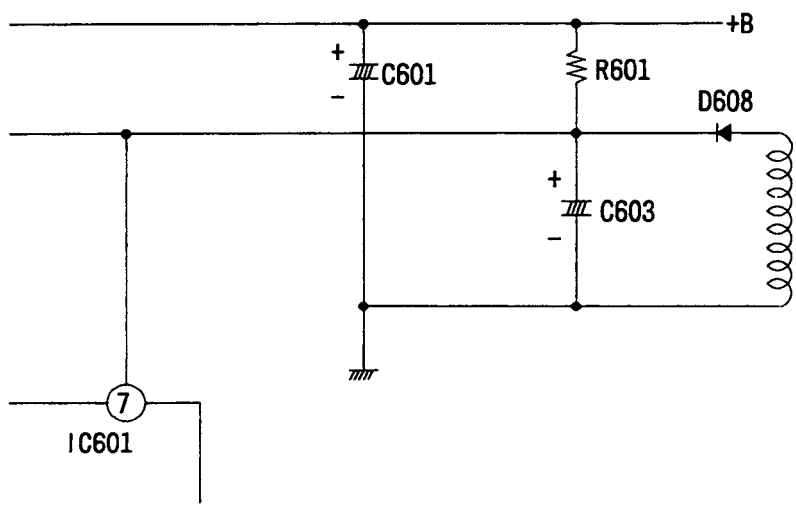



(Fig. 1-1-1) Rectifying and Filtering Circuit

**(b) Auxiliary power supply circuit**

The auxiliary power supply circuit is needed to activate IC601. At the time when the power is turned on, the charging current flows into the capacitors C603 via R601. Oscillation starts when the voltage of IC601 pin 7 reaches 16V by this charging operation.

After the start of oscillation, the flyback voltage of the auxiliary winding for the switching transformer is rectified and filtered by D608 and C603. The resulting DC voltage is supplied to IC601.

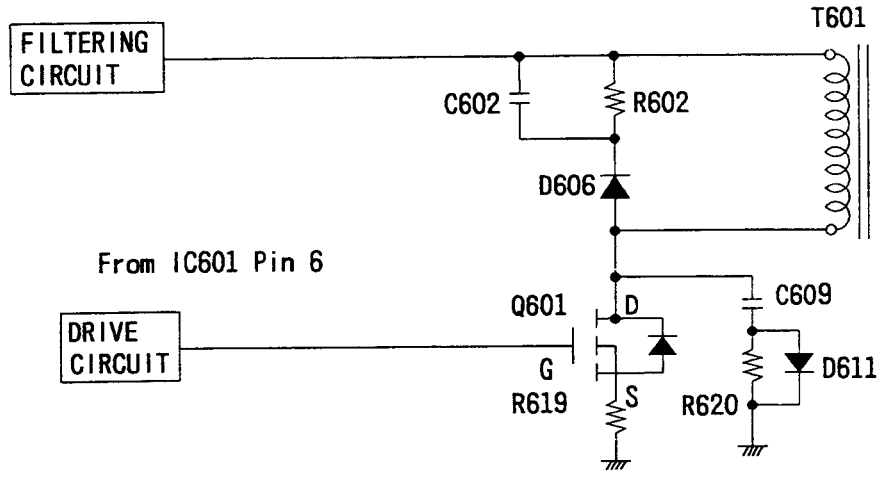



(Fig. 1-1-2) Auxiliary Power Supply Circuit

**(c) Converter circuit**

The converter circuit consists of the primary winding of the switching transformer T601, a switching device Q601, and surge absorbers (C602, R602, C609, R620, D606, and D611) that are connected to the primary winding.

The oscillating signal from IC601 pin 6 is applied to the gate of Q601 causing the drain-source to be turned OFF and ON so that the oscillating voltage is applied to the primary winding of T601.

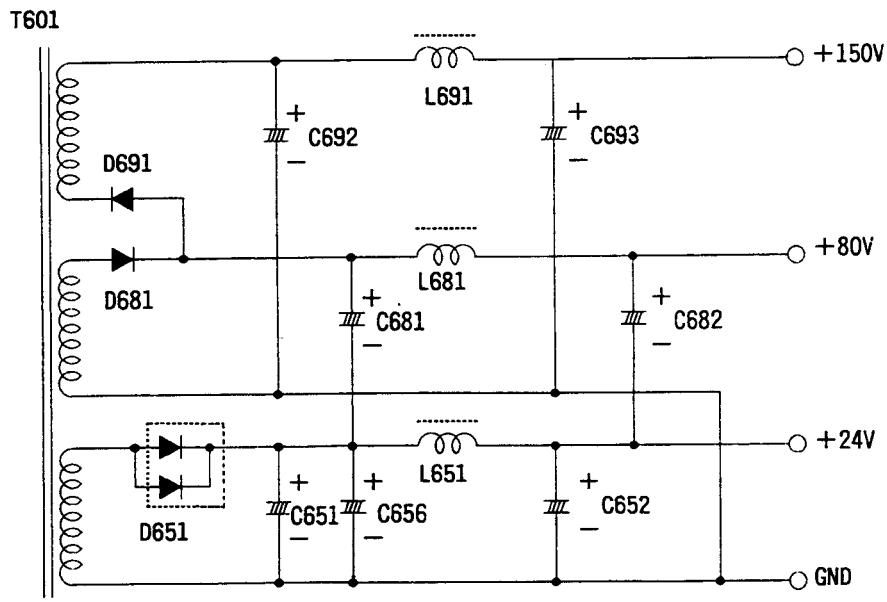



(Fig. 1-1-3) Converter Circuit

**(d) Output rectifying circuit**

The flyback voltages generated at the secondary windings of the switching transformer T601 are rectified by D651, D681, and D691. Then, these voltages are filtered by C692, C693, C651, C652, C656, C681, and C682 so that rectified DC voltages are obtained.

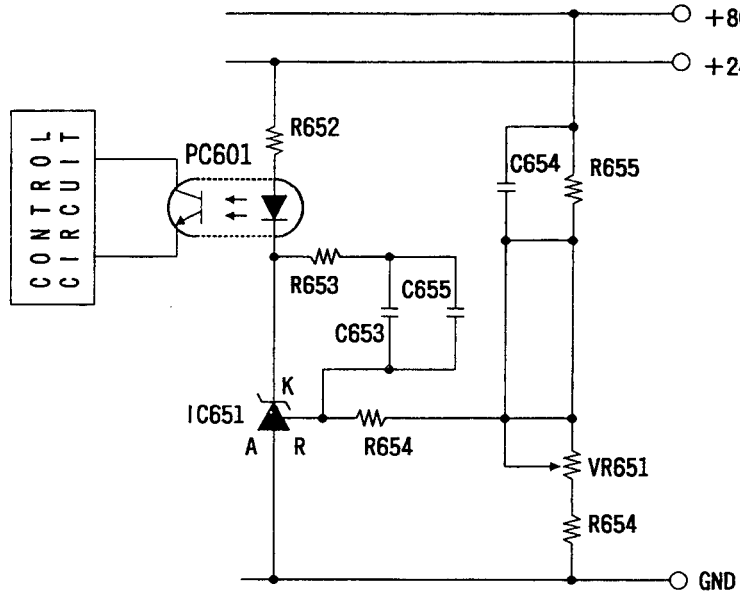
Constant flyback voltage are maintained by controlling the duty cycle of Q601 in the converter circuit.




(Fig. 1-1-4) Output rectifying Circuit

**(e) Error detection amplifier circuit**

The output voltage 80V is divided by the network resistors. This divided voltage is compared to the reference voltage at the error amplifier IC651. An error signal is applied to the control circuit via the photocoupler PC601.



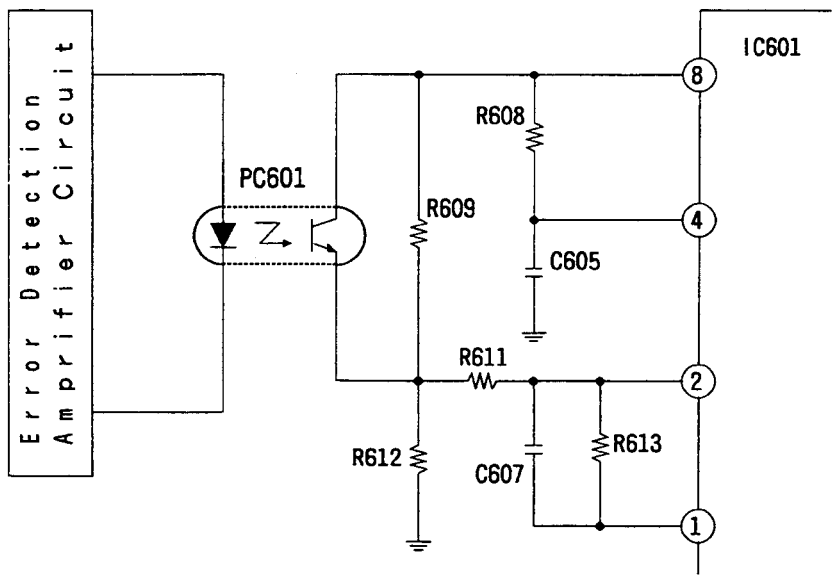

(Fig. 1-1-5) Error Detection Amplifier Circuit

**(f) Oscillating and control circuit**

The oscillating, control, and drive circuits are contained in IC601.

IC601 has a built-in oscillator whose frequency is determined by R608, and C605 connected to pin 4 and pin 8 respectively.

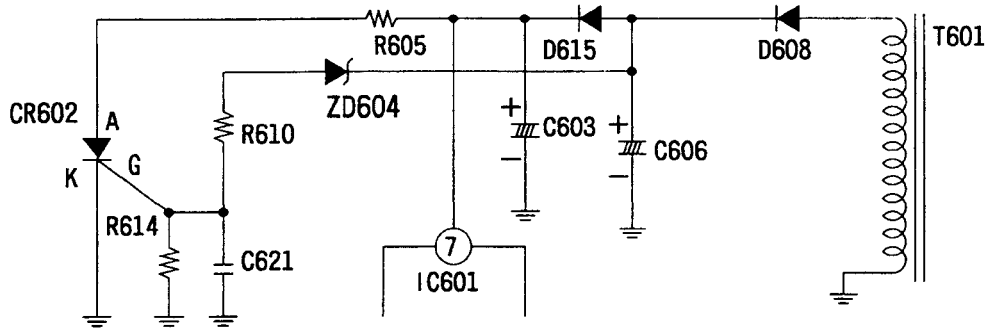
The output of the error detection amplifier circuit is fed back to the control circuit pin 2 from pin 8 via PC601 to control the duty cycle of Q601 so that output voltages are kept constant.




(Fig. 1-1-6) Oscillating and Control Circuits

**(g) Overvoltage Protection**

If a failure occurs and the output voltage on the secondary winding rises, the voltage of the auxiliary winding will also rise phoportiorally.When the auxiliary windings voltage rises beyond teh zener voltage of ZD404, CR402 will turn ON. This in turn will decrease the voltage at pin 7 of IC601 causing the oscillator within IC601 to stop.

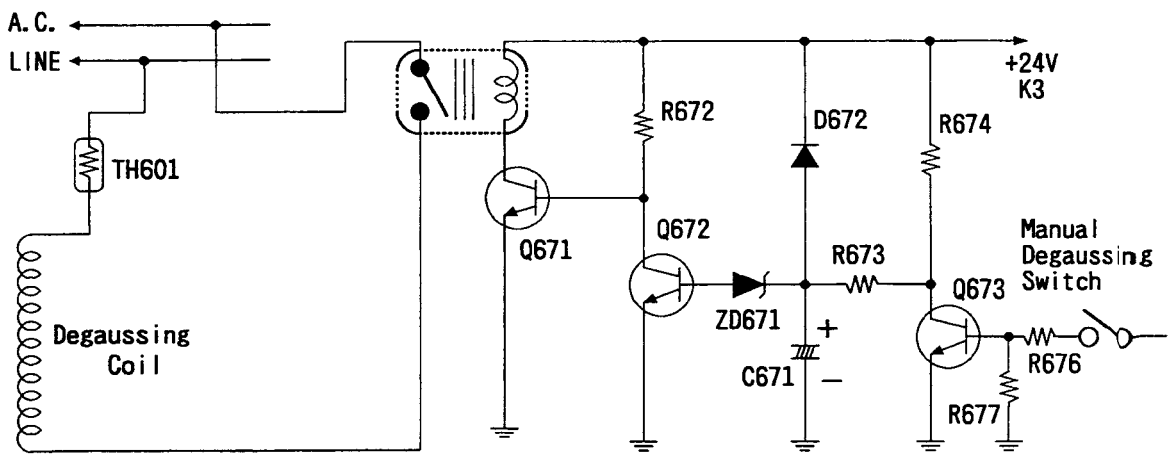



(Fig 2-1-7) Over Voltage Protection

**(h) Auto and Manual Degaussing Circuit**

1) Auto Degaussing Circuit
When the unit is turned ON. The +24V D.C. output at k3 rises. This will cause Q671 to turn ON. The ON period for this transistor is determined by R673, ZD671, R674, and C671 (approx. 2 seconds). When Q671 is ON, current will flow through the Degaussing Coil

2) Manual Degaussing Circuit
When the Degaus Switch is turned ON, Q673 conducts thereby discharging C671. When C671 is discharged, Q671 will turn on again.




(Fig. 1-1-8) Auto and Manual Degaussing Circuit

## 1-2. H.V. Voltage Circuit

H.V. generator circuit (Fig. 1-2-1)

H.V. generator circuit is composed of Q515, C530, C531, and FBT T503.
This circuit generators the flyback pulse. This pulse level is 450-550Vpp.
The flyback pulse is boosted up to the high voltage (24 KV) by FBT.
The High voltage is supplied to the anode of CRT from FBT.

H.V.drive circuit (Fig. 1-2-2)

This circuit generates the drive pulse for FET Q515 in H.V. generator circuit.
The input of IC501 (PIN ④) is supplied a trigger pulse from T502 of H.deflection circuit.
IC501 output the drive pulse of FET Q515, and Toff (See Fig. 1-2-3) of IC501 output pulse is decided 10$\mu$S by R530 and C528.
The output pulse of IC501 is supplied through emitter follower Q553, AC coupling capacitor C529 and buffer amp. of Q513, and Q514 to FET Q515.

H.V. generator or DC/DC converter circuit (Fig. 1-2-1)

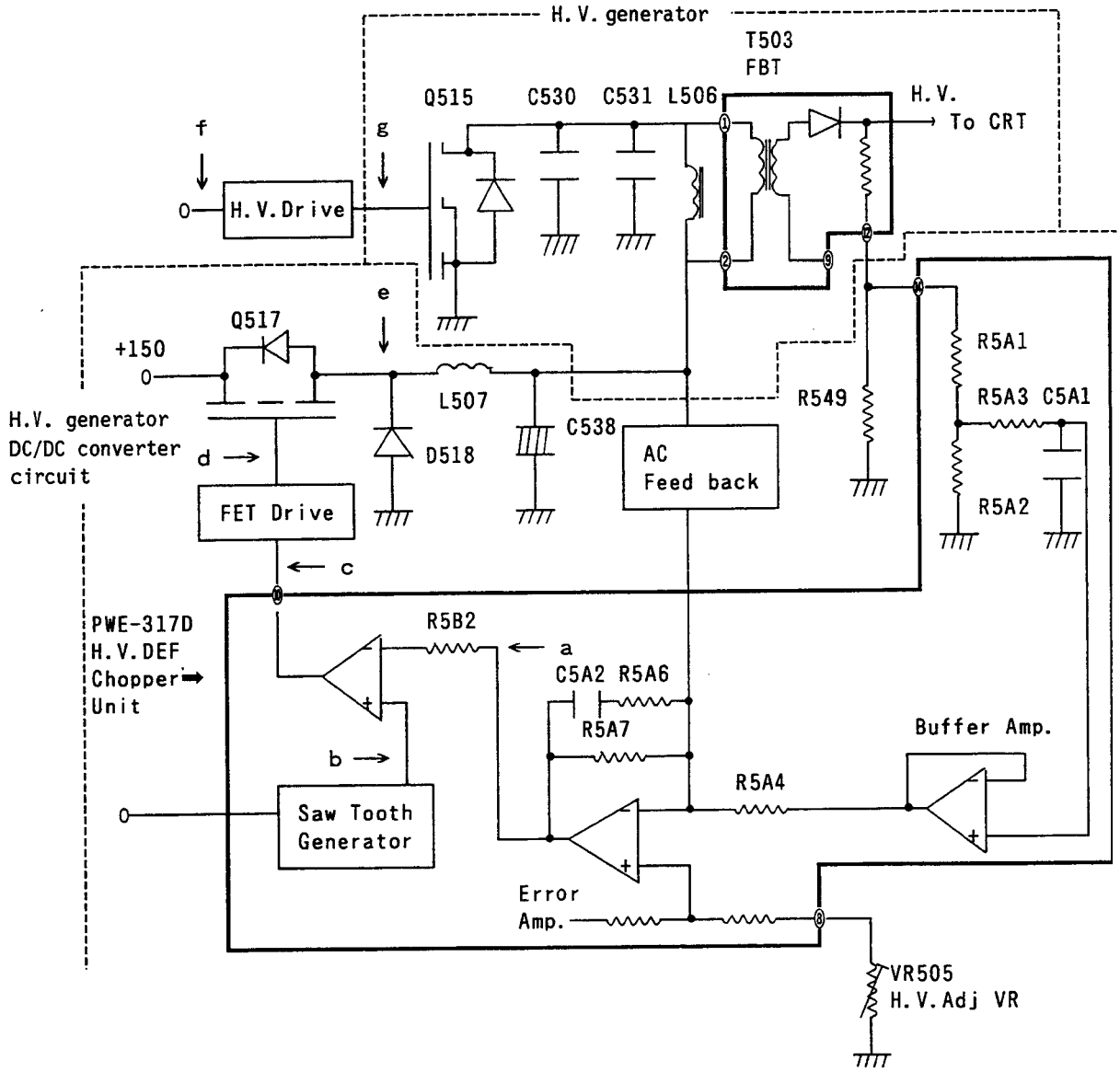
This DC/DC converter circuit is composed of a step down chopper, FET drive and control circuit.

This chopper circuit is composed of L517, D518 and C538.
This circuit supplies DC voltage of 35-120V to F.B.T.for H.V. regulation.

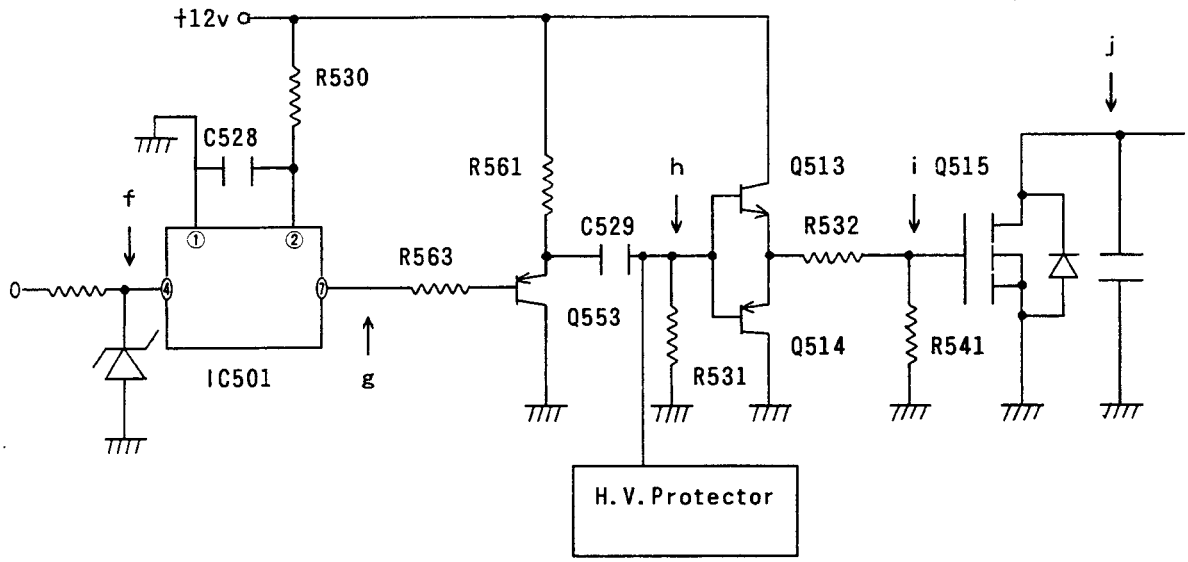
The relationship between outup DC voltage of chopper circuit and horizontal frequency is shown in Fig.1-2-6

The FET drive circuit composed of the buffer circuit of Q520, Q521, R571 and level shift circuit of R544, C537,R545, D517, ZD507.
The DC level of the output pulse from the control circuit (10 pin of PWE-317D) is shifted and is supplied to FET Q517 by this circuit.(See Fig.1-2-4)

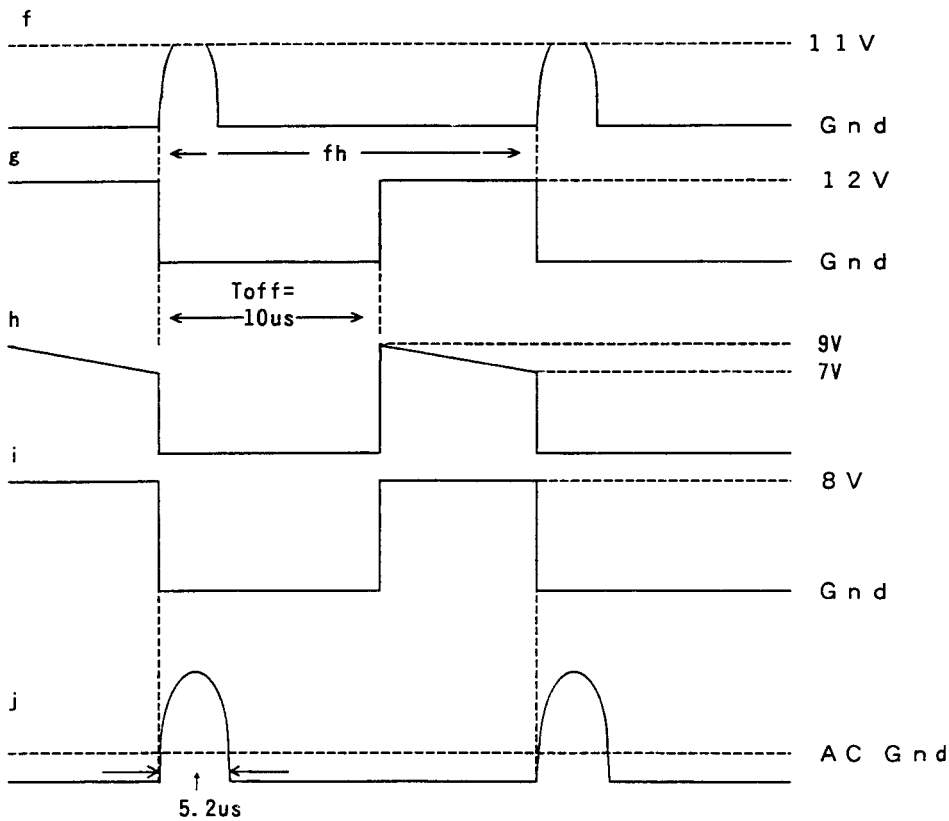
This control voltage is a negative feedback circuit and supplies PWM (Pulse Width Modulation) pulse through FET drive circuit to FET Q517.
High voltage output is divided by resistors of R549, R5A1, R5A2, and 450M ohm resistor in FBT.
This divided voltage is supplied to the buffer amp and to the errer amp.
The output voltage of the errer amp. is supplied to PWM circuit of IC5A2 (PWE-317D) and IC5A2 supplies PWMpulse through FET drive circuit to FET Q517.


H. V. generator
T503
FBT
Q515
C530
C531
L506
H. V.
To CRT
f
g
H. V. Drive
e
Q517
+150
L507
C538
D518
R549
R5A1
R5A3
C5A1
R5A2
H.V. generator
DC/DC converter
circuit
d
FET Drive
AC
Feed back
c
PWE-317D
H.V.DEF
Chopper
Unit
R5B2
a
C5A2
R5A6
R5A7
Buffer Amp.
b
R5A4
Saw Tooth
Generator
Error
Amp.
VR505
H. V. Adj VR

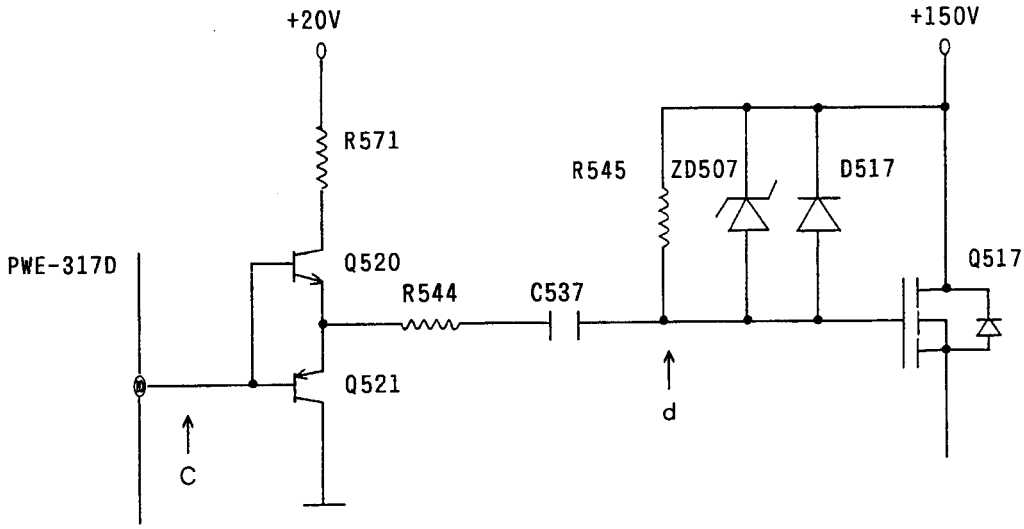
(Fig. 1-2-1)



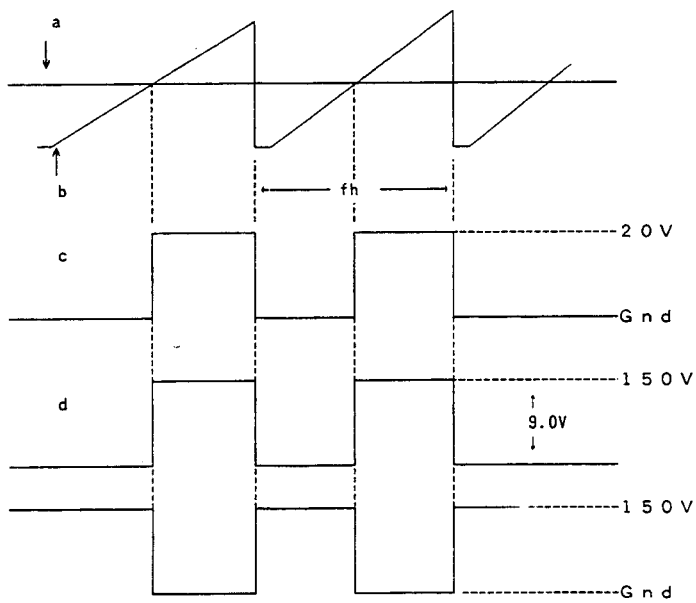

(Fig. 1-2-2) H.V. Drive Circuit



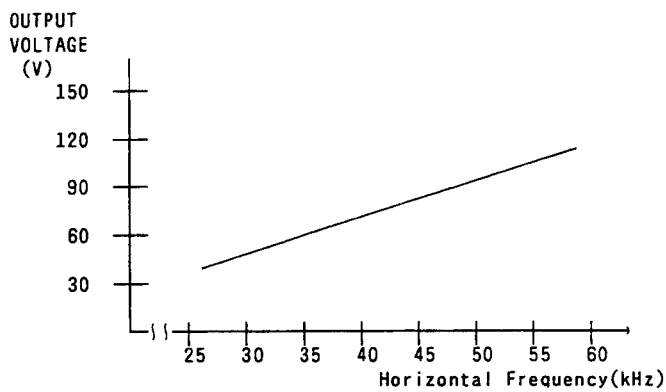

(Fig. 1-2-3)




(Fig. 1-2-4) FET Drive Circuit




(Fig. 1-2-5)




(Fig. 1-2-6) Relationship of the Horizontal frequency and the F.B.T.'s DC Supply Voltage

## 1-3. DC/DC converter for H.deflection circuit

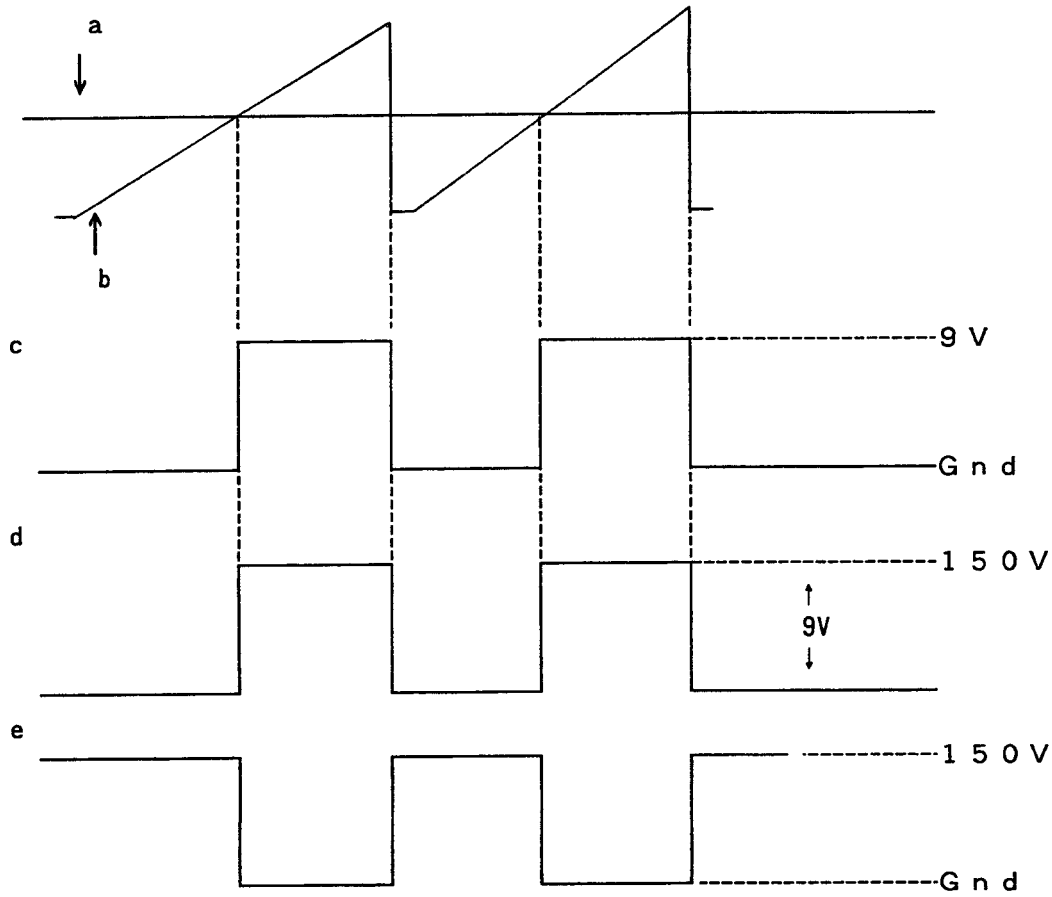
This circuit supplies DC voltage to H. deflection circuit and controls H. size and side-pin cushion correction by this output voltage.

This DC/DC converter circuit is composed of a step down chopper circuit type, FET drive circuit and control circuit.

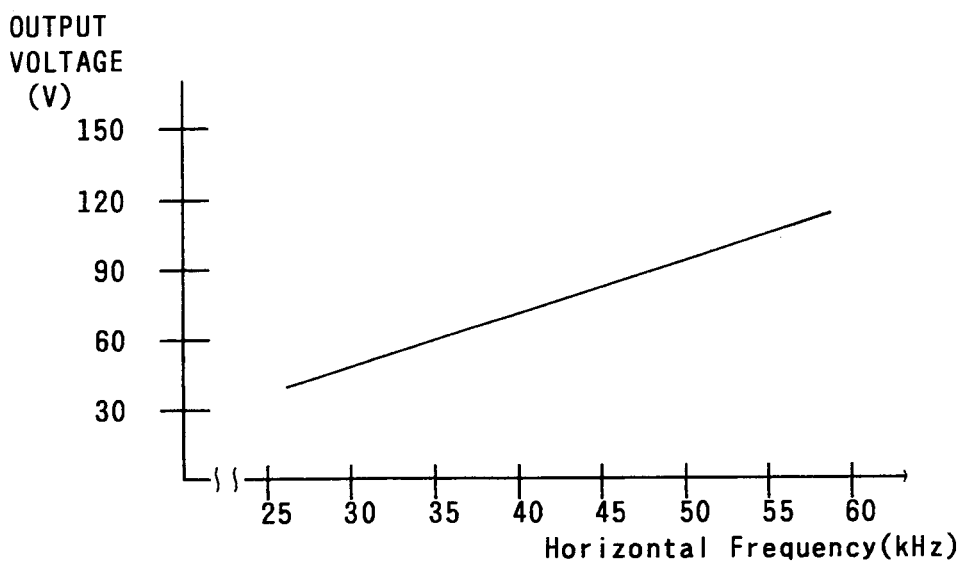
This chopper circuit is composed of Q510, L504, L505, D508, C521, and C522.
This circuit supplied DC voltage of 35-120V to the H. deflection circuit. The output voltage level is in proportion to H. size and horizontal frequency.
The relationship between output DC voltage of the chopper circuit and horizontal frequency is shown in Fig-1-3-4.

The FET drive circuit is composed of the buffer circuit of Q518, Q519, R570 and level shift circuit of R522, R523, C520, D506, D507, and ZD503. The DC level of the output pulse from the control circuit (PIN 9 of PWE-317D) is shifted and is supplied to FET Q510 by this circuit. (Fig. 1-3-2)

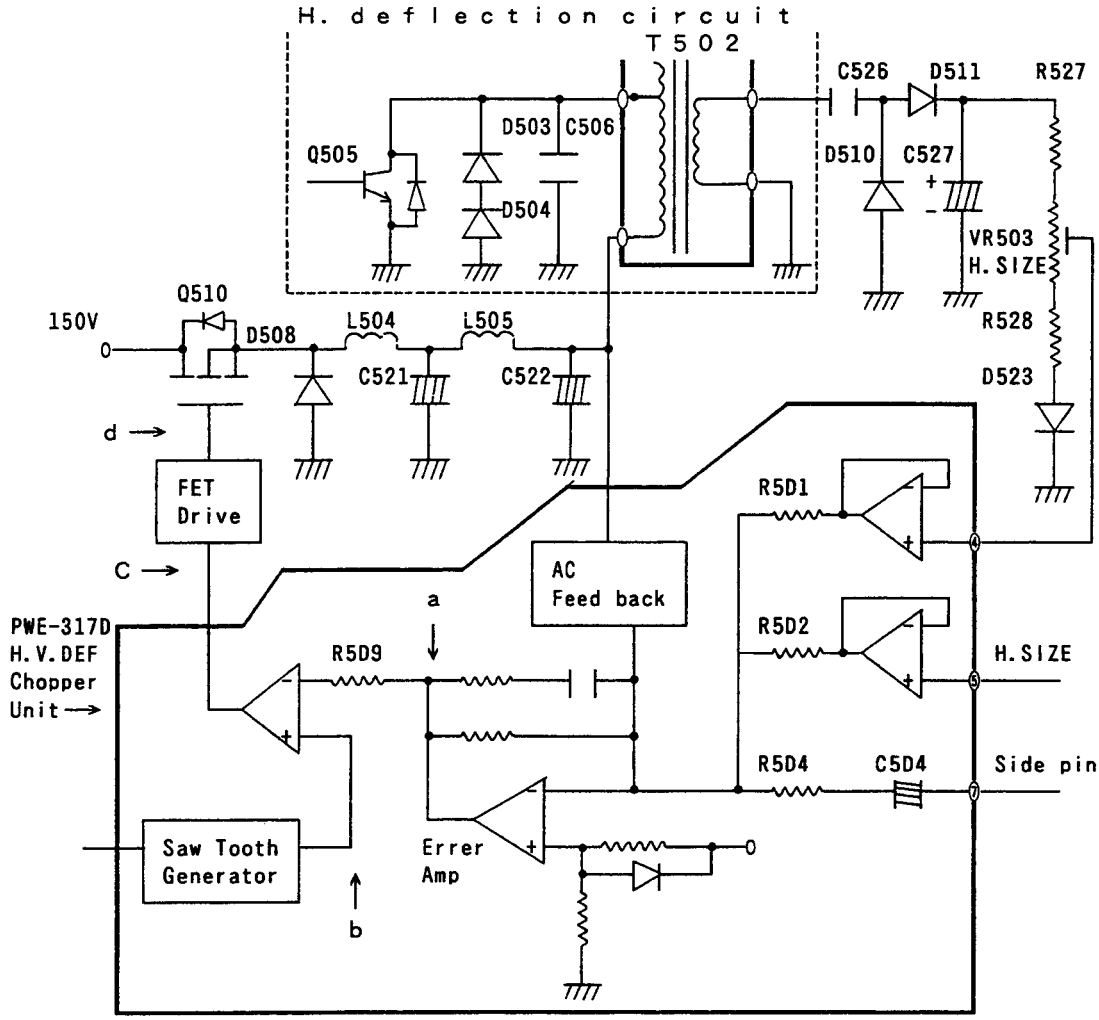
The control circuit is a negative feedback circuit and supplies PMW (Pulse Width Modulation) pulse through FET drive circuit to FET Q510.
The output pulse of T502 is clamped by C526, D510 and is rectified by D511 and C527.
The value of this rectified voltage is same as the crest value of T502 output pulse.
This rectified voltage is divided by R527, R528, D523, VR503 (H. SIZE VR) and is supplied through buffer amp.to the error amp. in PWE-317D. H. size control voltage and sidepin cushion signal is supplies to the negative input of error amp.
The output voltage of the error amp is modulated.
The output voltage of the error amp is supplied to PWM circuit of IC5A2.
The output of error amp. is converted to PMW pulse by IC5A2 and the PWM pulse of IC5A2 output is supplied through FET drive circuit to FET Q510.



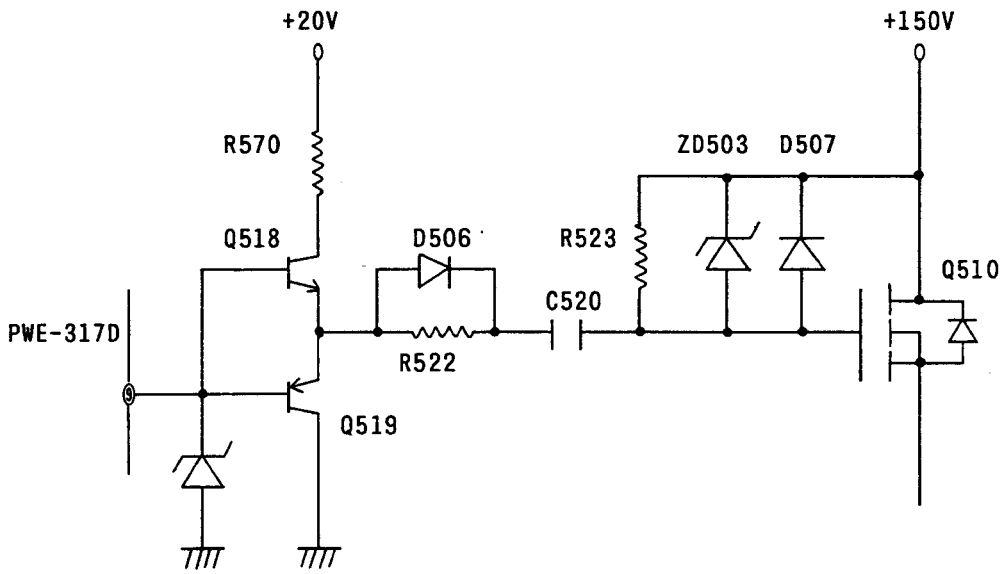

(Fig. 1-3-3)




(Fig. 1-3-4) Relationship of the Horizontal frequency and the horizontal deflection's DC Supply Voltage




(Fig. 1-3-1) DC/DC Converter for H. deflection Circuit




(Fig. 1-3-2) FET Drive Circuit

## 1-4. Low voltage chopper regulator circuit

The low voltage chopper regulator circuit is PWM controlled and synchronized with the H. deflection DC/DC convertor output of the DC/DC converter.

·The pulse duty is determined by comparing the saw tooth waveform and the feedback voltage through error amp. of IC511 with a comparator of IC512. This feedback circuit is automatically controlled and generates constant and stable output voltage.

If the H.OSC operation stops, the output voltage will become low. The output voltage of 6V line is limited by low +B protector.

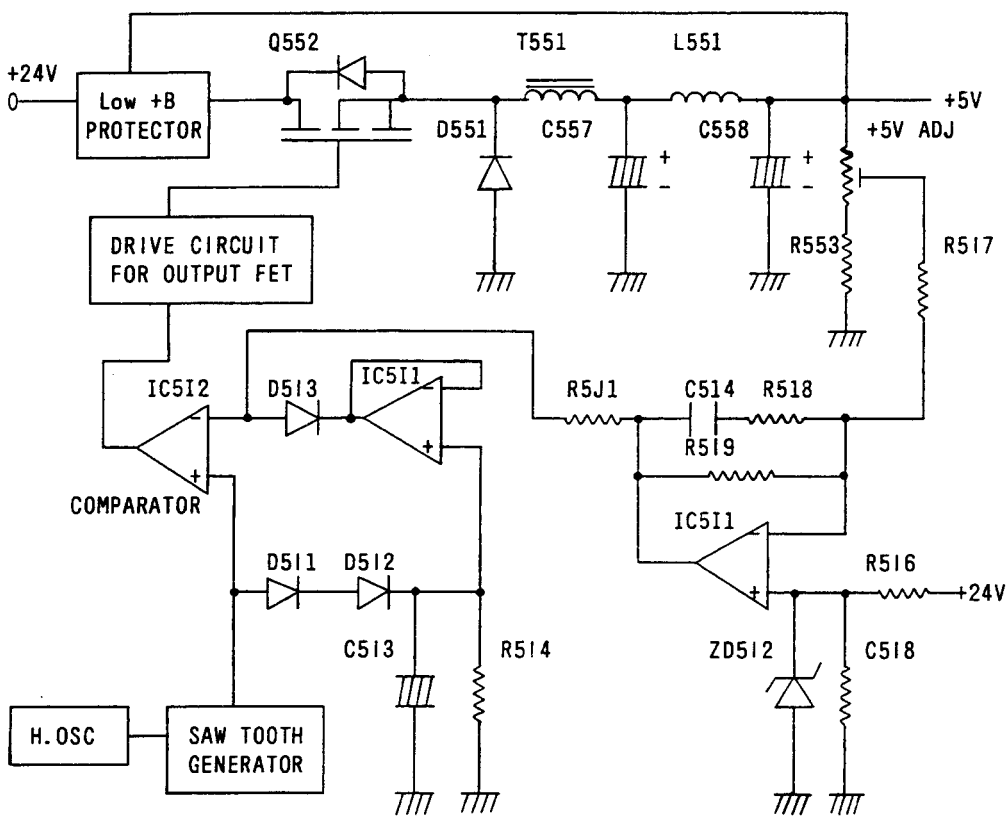
This circuit generates 6V power supply from the pulse of T551's primary winding and 5V power supply from the 6V power supply by using 3 terminal regulator of IC864. By using the pulse induced in teh secondary windings, 12V, −15V, −5V and horizontal raster centering power supply can be obtained.

As for 12V power supply, it is obtained as below.

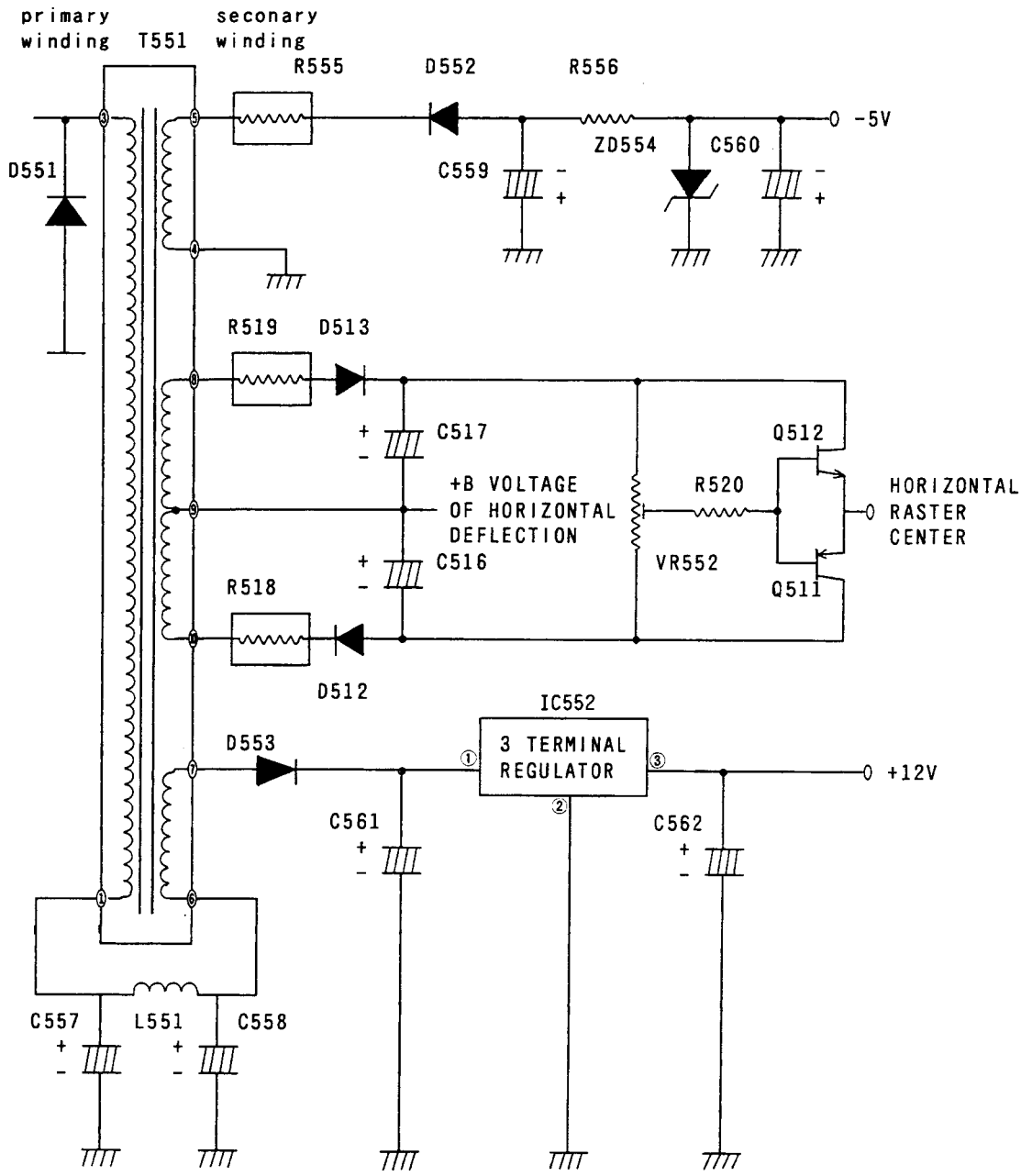
After adding the pulse induced between PIN ⑥-⑦ of T551 and the generated +6V, it is rectified by D553 and C561. Then the rectified voltage of 13V or a little more voltage is obtained. 12V power supply is obtained from this voltage by using 12V 3 terminal regulator of IC552.

As for −15V power supply, it is obtained by rectifying the voltage induced between PIN ④-⑤ of T551 by D552 and C559. As for −5V power supply, it is obtained by using zener diode and as for horizontal raster centering power supply, it is obtained by rectifying the voltage of PIN ⑨ and PIN ⑩ with their middle point (PIN ⑨) connected to the +B voltage of horizontal deflection.

The voltage of PIN ⑧ is rectified by D513 and C517. The voltage of PIN ⑩ is rectified by D512 and C516.




(Fig. 1-4-1) BLOCK-DIAGRAM of the Low Voltage Chopper Regulator



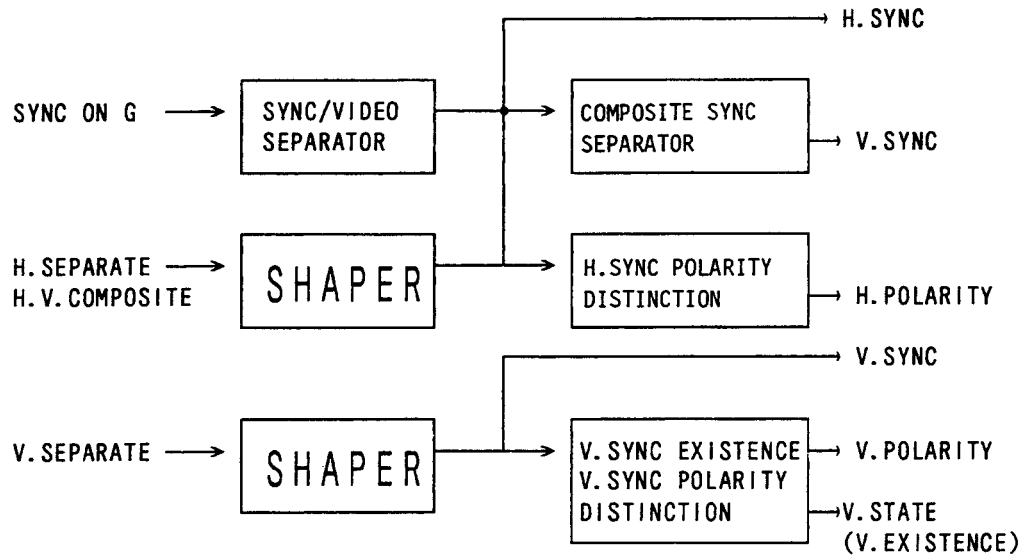

(Fig. 1-4-2) -15V, −5V, +12V and Horizontal Raster Centering power supply Circuit

# 2. Interface Circuit

## 2-1. Sync Interface Circuit

(a) The outputs of this circuit are the positive H Sync and V Sync.
The following three signals are designed as input signals.

(i) SEPARATE SYNC POSITIVE/NEGATIVE polarity
(ii) COMPOSITE SYNC POSITIVE/NEGATIVE polarity
(iii) SYNC ON GREEN NEGATIVE polarity




(Fig. 2-1-1) BLOCK-DIAGRAM of the SYNC INTERFACE CIRCUIT

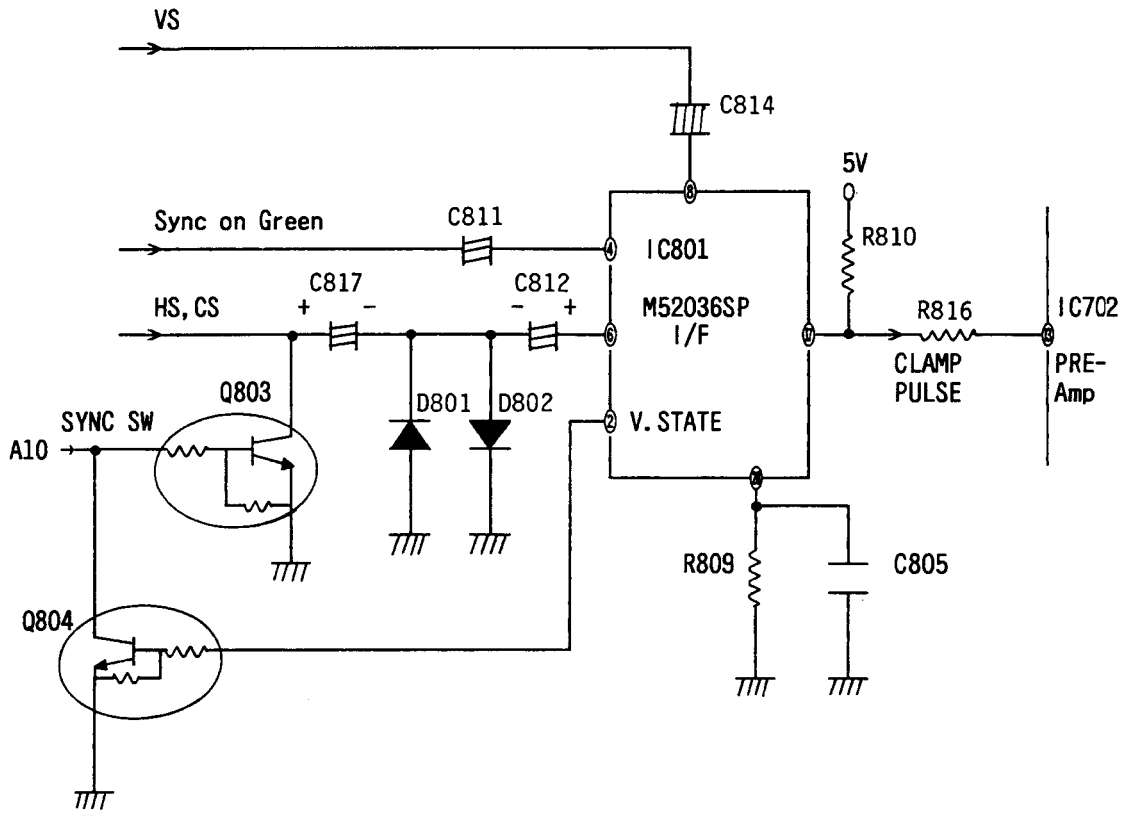
(b) The outputs of the distinction circuit are as follows:
These outputs are supplied to IC851 (CPU) on the main PWB.

- H SYNC signals's polarity (CN-A PIN 1) { L: POSITIVE POLARITY / H: NEGATIVE POLARITY
- V SYNC signal's polarity (CN-A PIN 2) { L: POSITIVE POLARITY / H: NEGATIVE POLARITY
- V SYNC STATE (EXISTENCE)(CN-A PIN 3) { L: NONE / H: AVAILABLE

**NOTE:** L . . . Low level of TTL
H . . . High level of TTL

## 2-2. SYNC.SW and Video Clamp Pulse Circuit

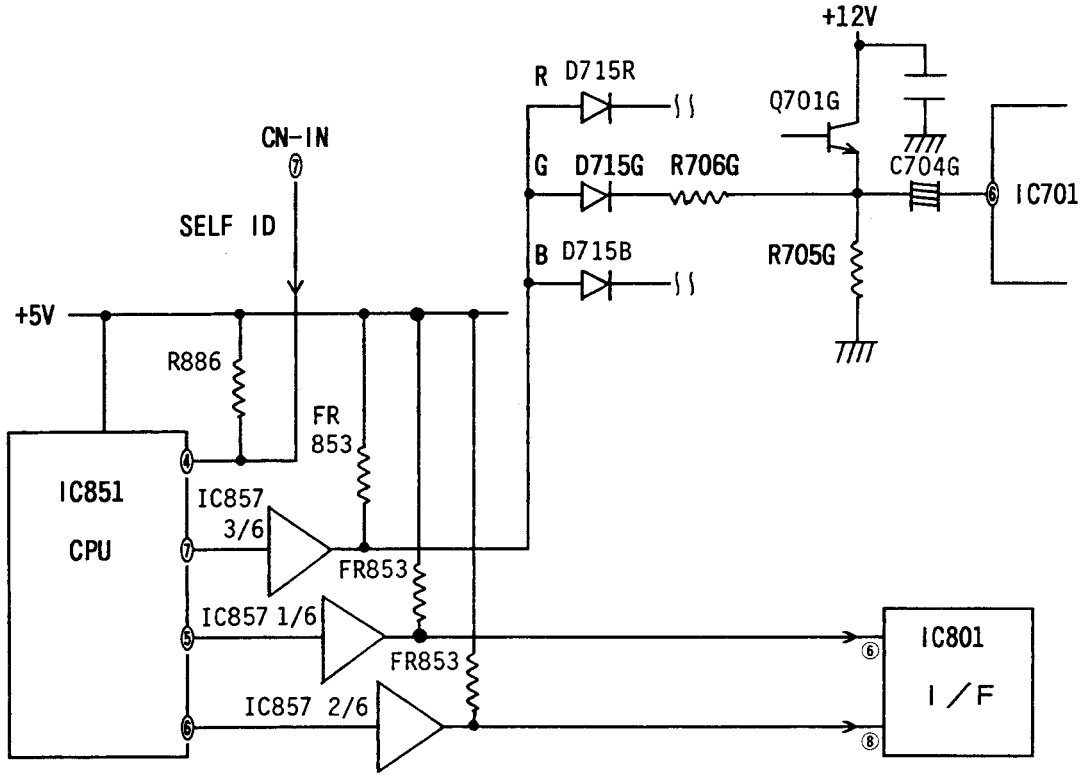
The clamp pulse for IC702 (PRE-AMP) is generated at PIN ⑰ of IC801. In case of the separate H. sync and Comp sync, the clamp pulse is triggerd by the front edge of H. sync and the pulse width is determined by C805 and R809. In case of the Sync. on Green and separate H. sync, the clamp pulse is generated at the back edge of the H. sync. If the Comp Sync and Sync on Green are input at the same time, (ex. Macintosh II), the Comp Sync is CUT by the Sync SW. When Sync SW is OFF, the base of Q803 is High level and Q803 is turned ON. Then the Comp Sync is CUT. The SYNC SW operation effective in case of no separate V. sync at PIN ⑧ of IC801. If the separate V. sync is input at PIN ② of IC801 is High Level and Q804 is turn ON, the sync SW operation is not useable.




(Fig. 2-2-1) Sync SW and Clamp Circuit

## 2-3. Self Test Circuit

When the signal cable is disconnected flom the video card/computer, PIN ⑦ of CN-IN and PIN ④ of IC851(CPU) are set High. Then H. sync (PIN ⑤), V. sync (PIN ⑥) and video (PIN ⑦) compose the CPU generated self test pattern.

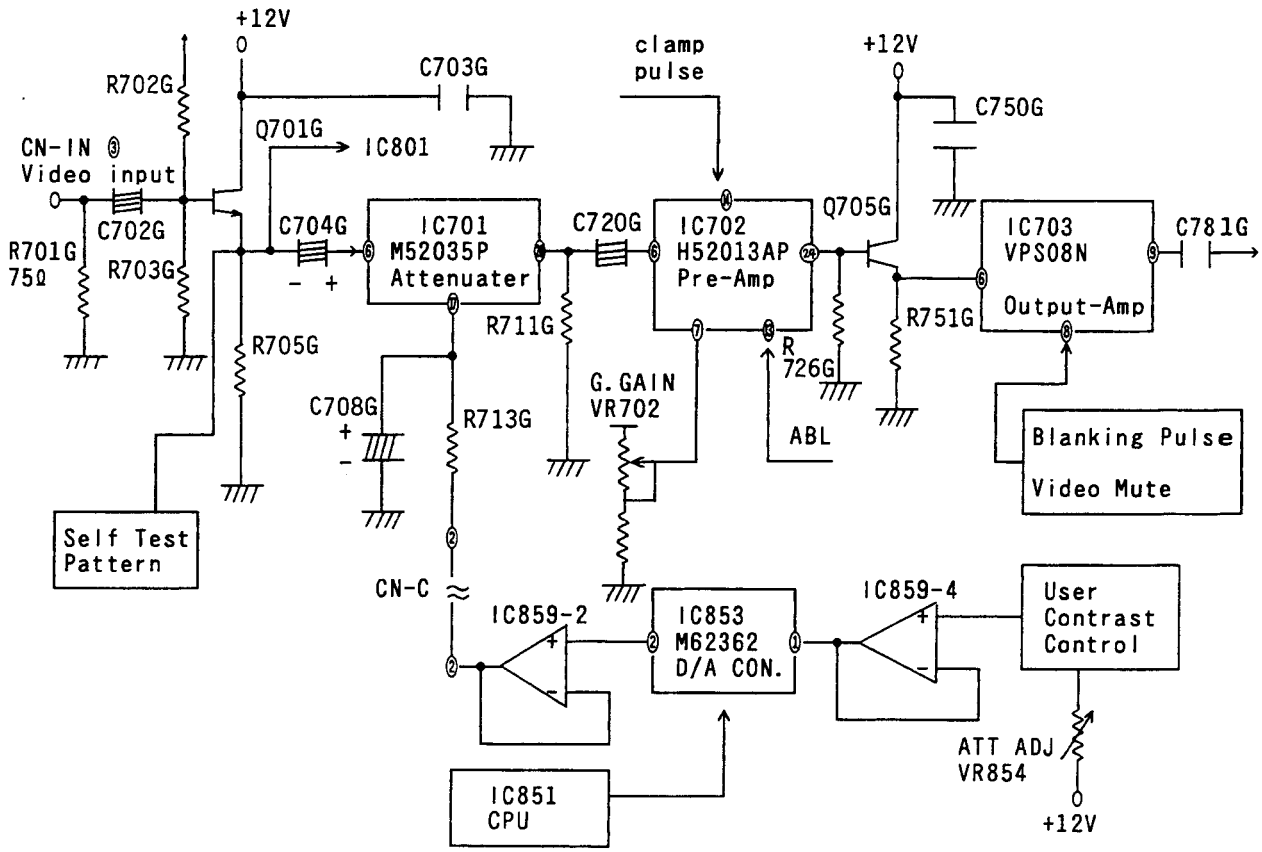



(Fig. 2-3-1) Self Test Circuit

# 3. Video System

## 3-1. Video signal amplifier

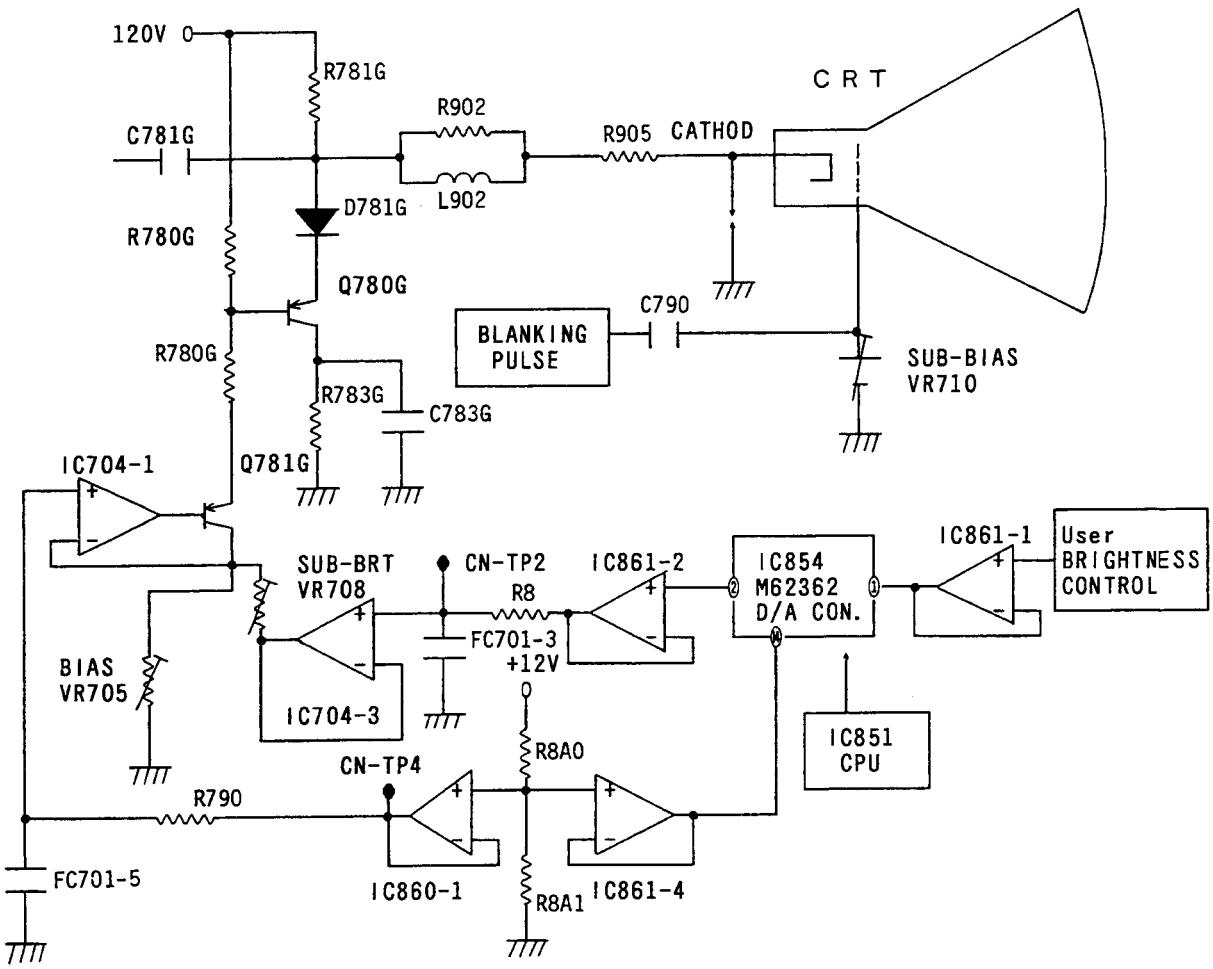
The three video circuits are the same for the each R/G/B color. Threfore only the Green video circuit will be explained here. The Green video signal input is fed to the PIN ⑥ of IC701 through the Q701G. The video signal is attenuated by IC701,and the attenuation level is controlled by the user contrast control. The output signal of IC701 is supplied to IC702. The output signal of IC702 PIN ㉔ is supplied to IC703. IC702 is preamplifier, and the gain is adjustable by the GAIN VR702. IC703 is output amplifier.




(Fig. 3-1-1) BLOCK DIAGRAM of Video signal amplifier

## 3-2. Brightness and cut-off circuit

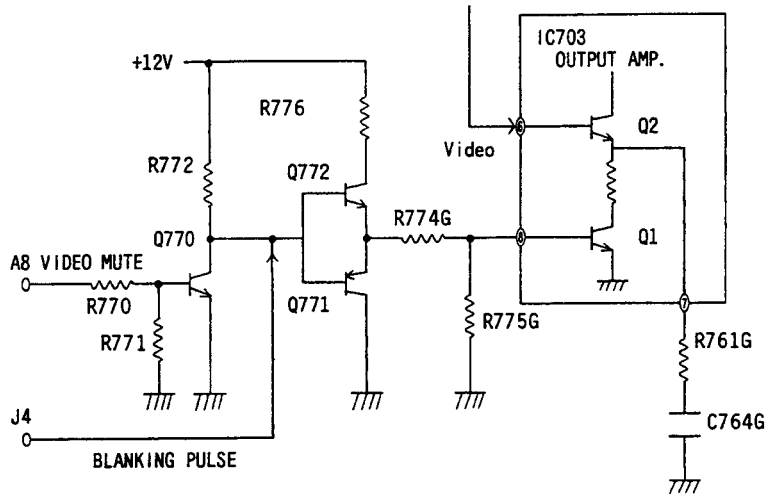
The raster brightness level is determined by clamping the video output blanking level from IC703. The DC clamp level is determined by using the voltage drop of R780G (which is basically determined by the current of Q781G). The raster brightness level is determied by the voltage at the output of IC704-3. When the voltage of Q781G emitter is same voltage as the output of IC704-3, the DC clamping level is at cut-off level.




(Fig. 3-2-1) Brightness and cut-off Circuit

## 3-3. Video Blanking Circuit and Video Mute Circuit

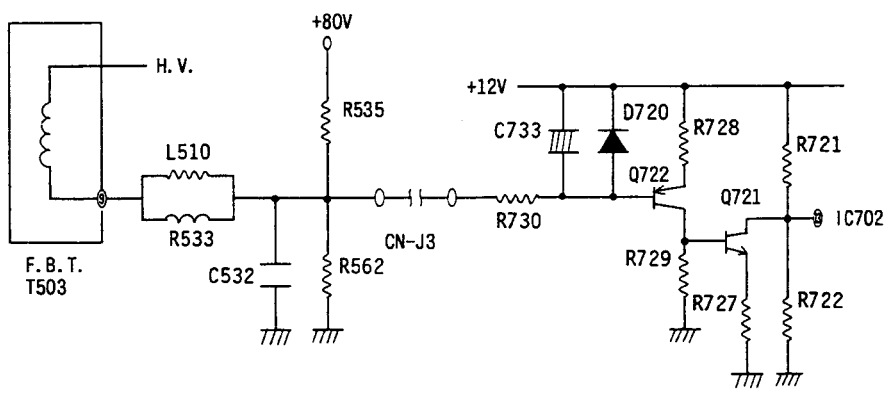
The H.blanking pulse is applied to the push pull circuit which is composed of Q771 and Q772. During the blanking period this pulse turn on the transistor Q1 and the video amplifier at cut-off. The video mute signal is generated at the CPU(PIN ⑧), when input signal is changed. Q770 is turned on by the video mute signal from the CPU. Then Q1 is turned off and the video amplifier is cut-off during the time that the video mute signal is generated.




(Fig. 3-3-1) Video Blanking and Mute Circuit

## 3-4. ABL Circuit

The maximum average current flowing through the CRT is controlled to under 450uA by limiting the video Vp-p swing. The voltage of CN-j3 is clamped at 12.6V by D720 when the anode current is 450uA or less. If the anode currentexceeds 450uA, the voltage of CN-J3 drops to less than 12.6V due to the voltage drop of R535. This drives Q722 and Q721 to decrease the collector potential of Q721, and the gain of IC702 is decrease.




(Fig. 3-4-1) ABL Circuit

# 4. Digital Control System

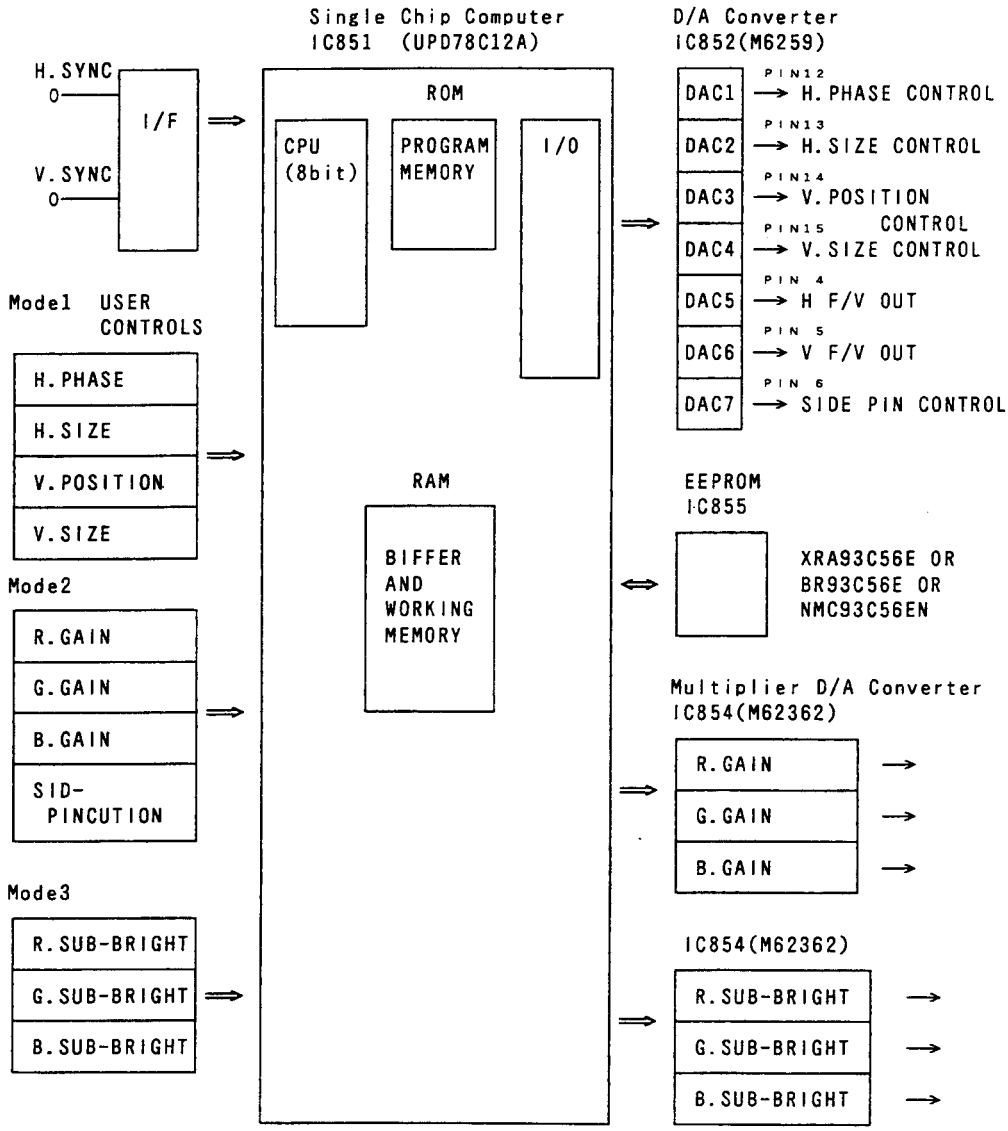
## 4-1. Digital Control Circuit

The following items are controlled by the Digital Control System.

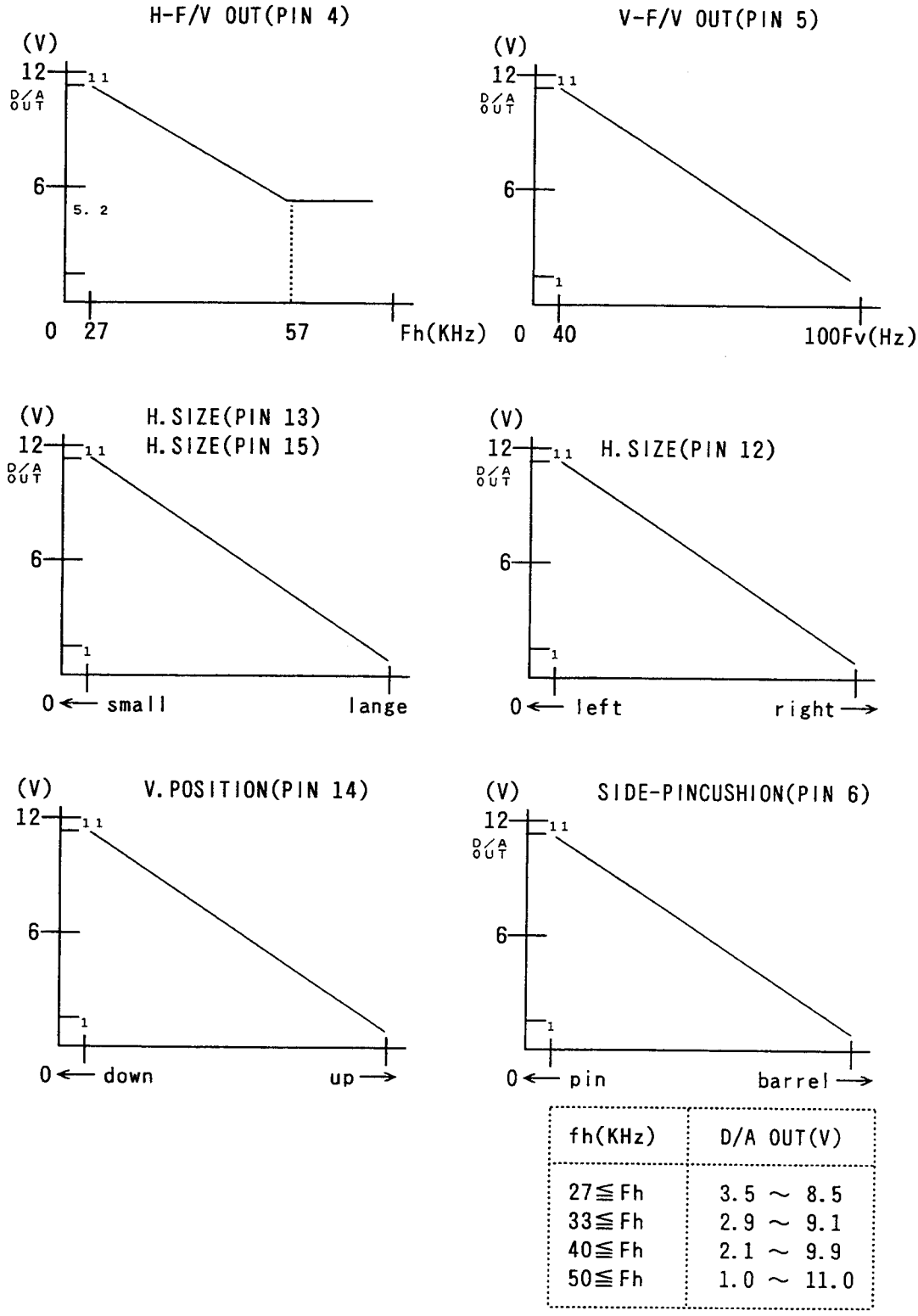
Digital Control System

- Automatic Synchronization
- Management of proper picture display
- Management of the user controls
- Management of the color correction
- Management of the side pin data
- Management of the factory adjustment
- Automatic Signal Identification
- Automatic Sizing
- Automatic Centering
- Memory of Picture Data

The relationship of the input and the output of CPU (IC851) is shown on Fig. 4-1-1

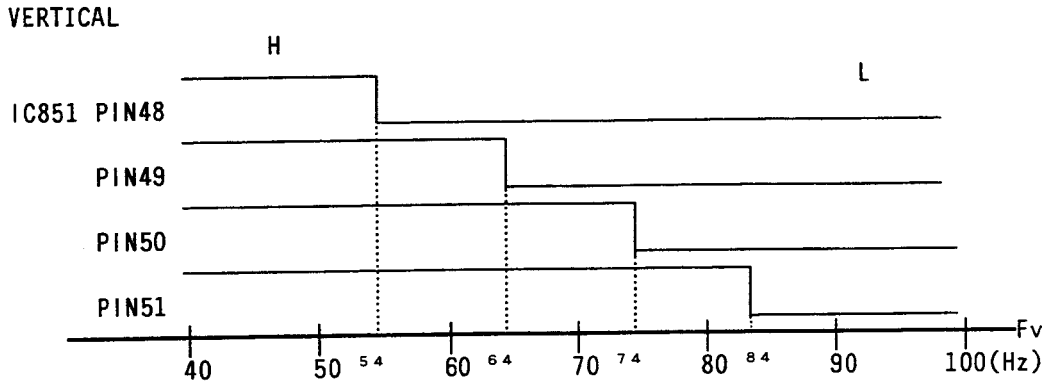


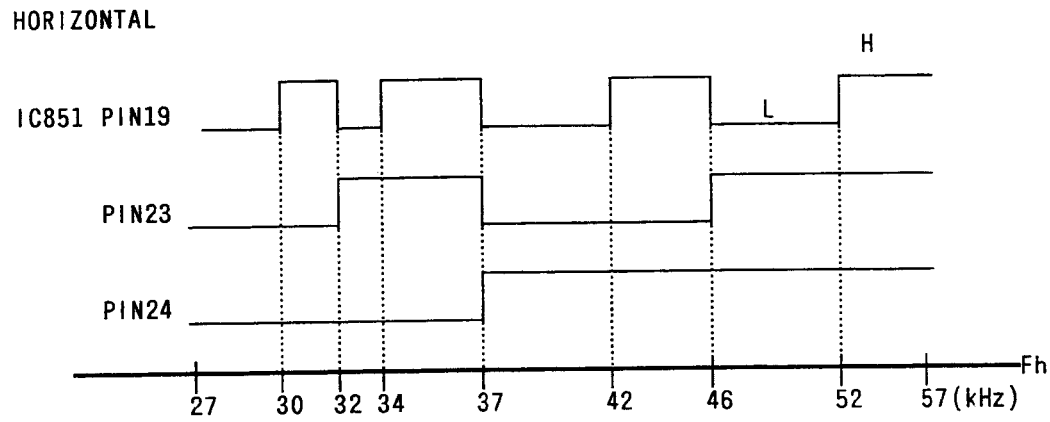

(Fig. 4-1-1) The BLOCK DIAGRAM of Digital Control System




| fh(KHz) | D/A OUT(V) |
|---|---|
| 27≦Fh | 3.5 ～ 8.5 |
| 33≦Fh | 2.9 ～ 9.1 |
| 40≦Fh | 2.1 ～ 9.9 |
| 50≦Fh | 1.0 ～ 11.0 |

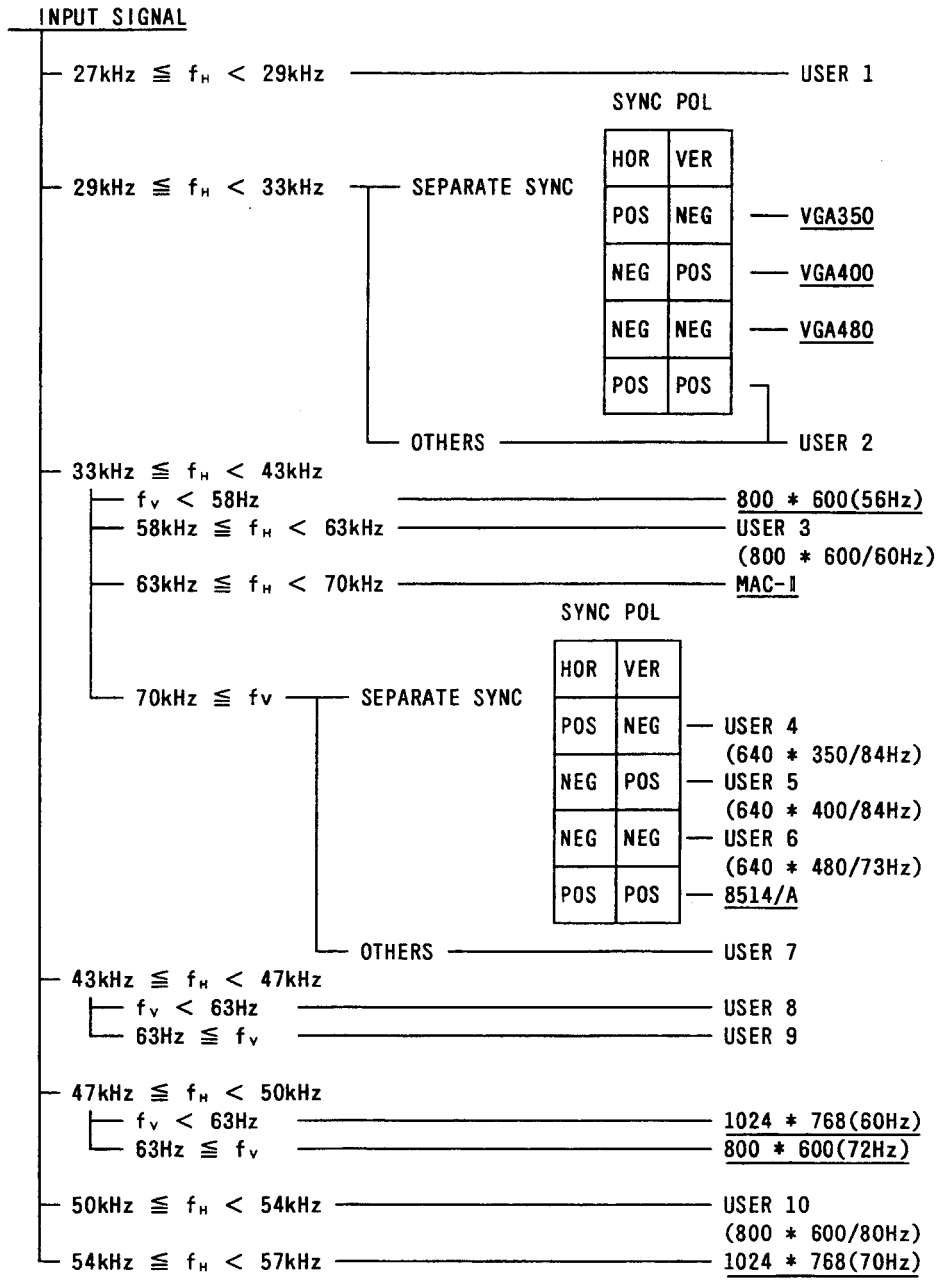
(Fig. 4-1-2) The D/A converter output




(Fig. 4-1-3) The fH and fV Band-Signals

## SIGNAL IDENTIFICATION FLOWCHART




**NOTE:** SIGNALS with under line have back up Memory (9 SIGNALS).

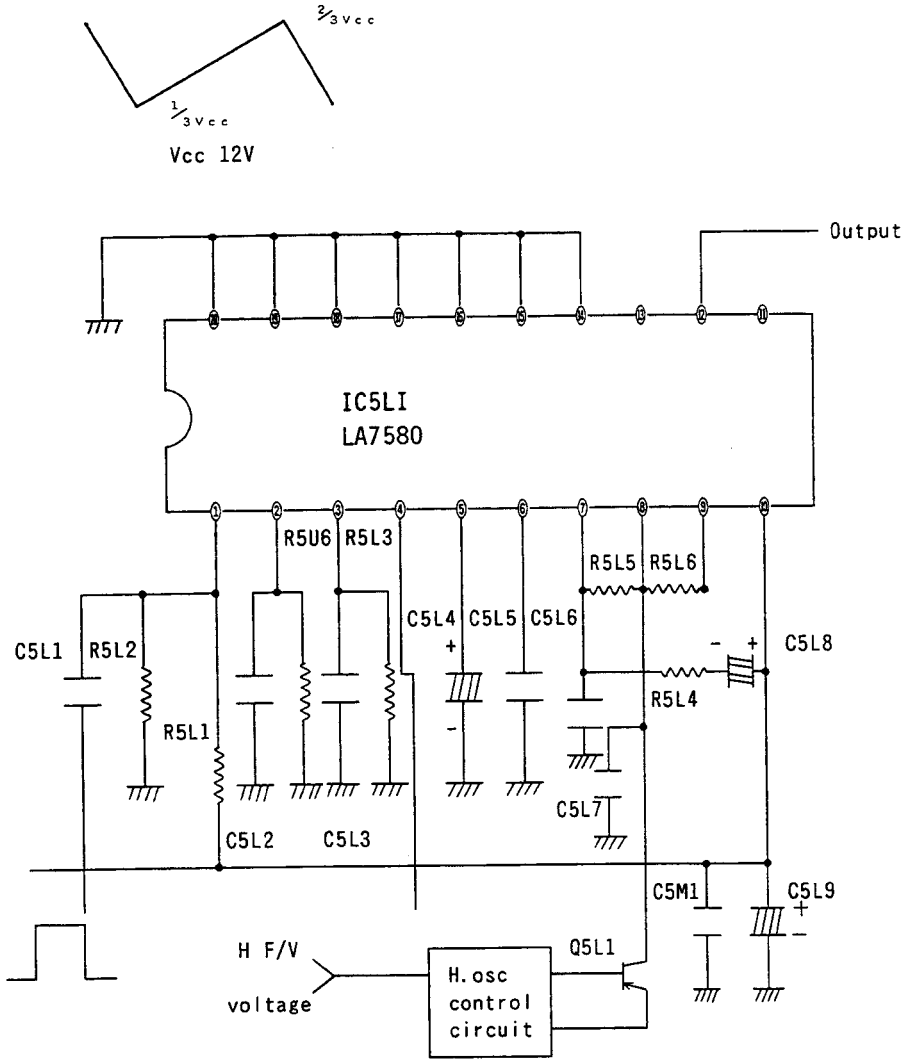
# 5. Deflection System

## 5-1. Horizontal system

### 5-1-1. Horizontal synchronization circuit

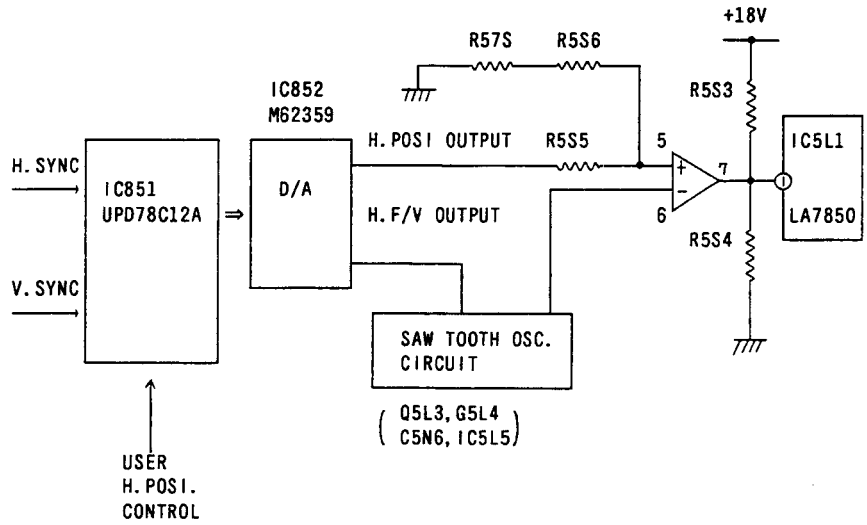
AFC and Hori zontal Oscillation are conducted by inputing Sync signal, Horizontal Output pulse and Horizontal Oscillation Control current to IC5L1 (LA7850). The output of horizontal phase circuit is input to IC (PIN ①) as the Sync signal via C5L1. Sync signal is triggered at the breaking edge by the Bias voltage which is determined by R5L1 and R5L2. Horizontal Output pulse is input to IC5L1 (PIN ④) and the Saw Tooth Wave is generated at IC5L1 (PIN ⑤).

AFC circuit is composed by C5L5,C5L6, C5L8,R5L4 and R5L5. Horizontal Oscillation Control current flows into the C5L7 through Q5L1 collector. When the voltage at IC5L1 (PIN ⑧) reaches 1/3 Vcc to 2/3 Vcc, Charge and Discharge of C5L7 is switched by IC5L1 and the Saw Tooth Wave is generated. Horizontal Oscillation control current is controlled by H-F/V voltage.



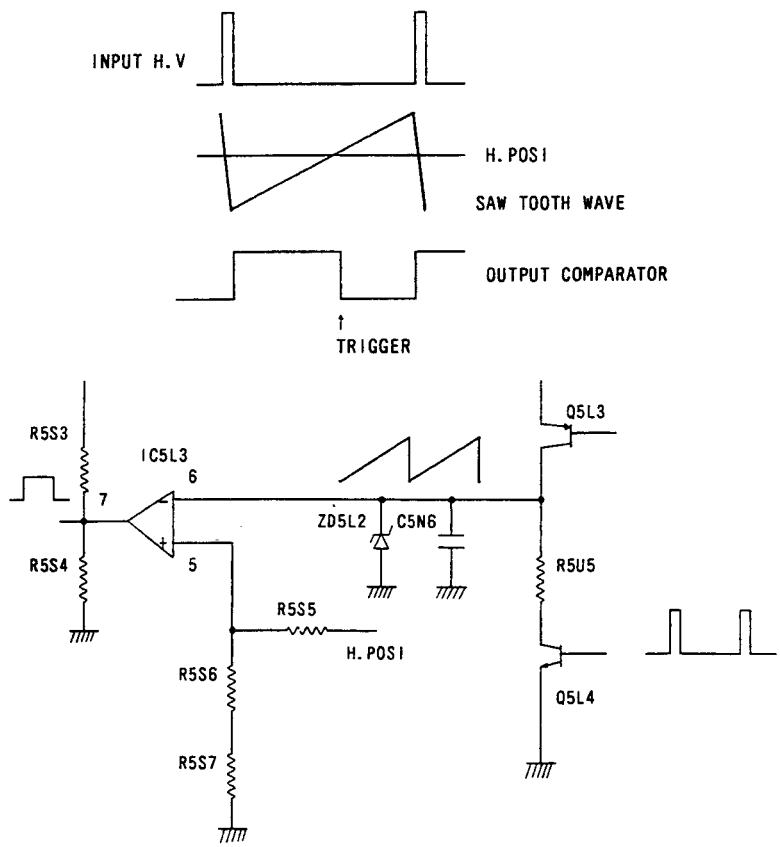

(Fig. 5-1-1) Horizontal Synchronization Circuit

### 5-1-2. Horizontal phase circuit




(Fig. 5-1-2) BLOCK DIAGRAM of the H. phase circuit

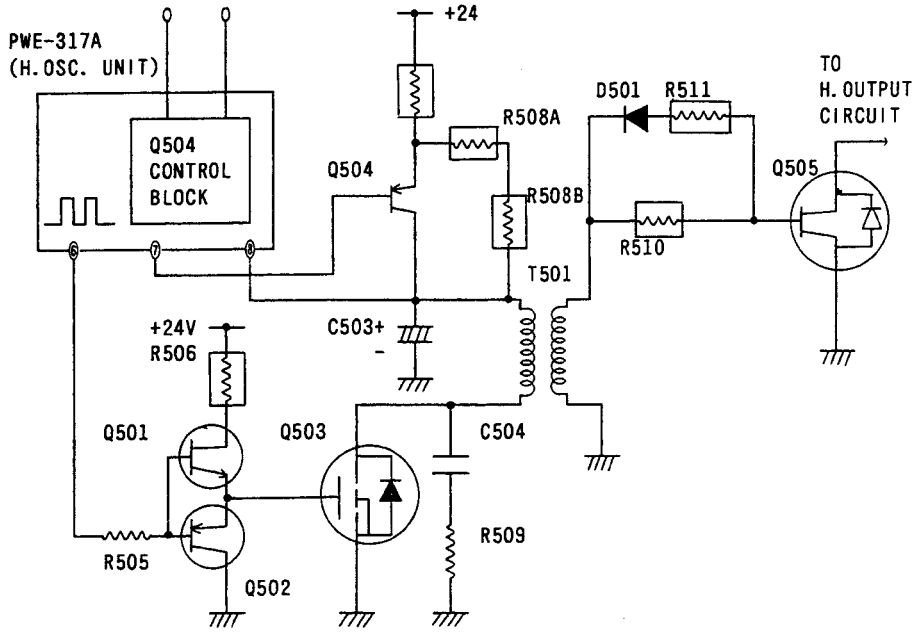
Horizontal Position is to be adjusted by delaying the Horizontal Sync signal phase input to LA7850. IC5L3's inputs of H. position control voltage and saw tooth waveform are generated from the H. sync timing. The comparator's output duty cycle varies with the H. position control voltage. The sync signal phase can be delayed by triggering to LA7850 on the breaking edge.



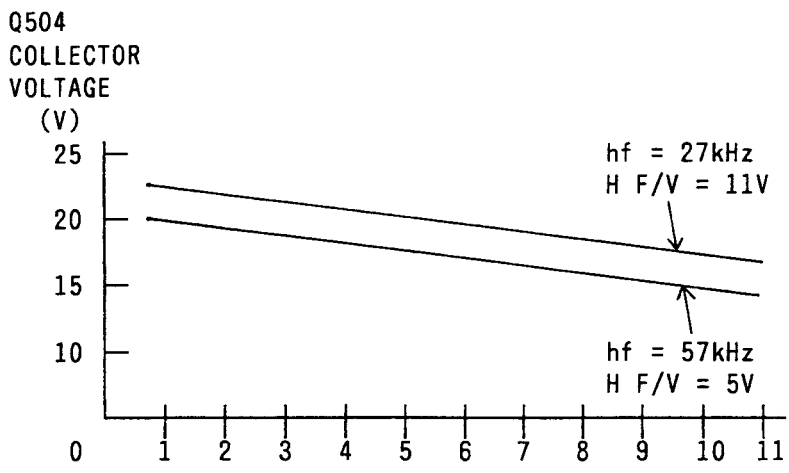

(Fig. 5-1-3) SAW TOOTH OSC Circuit

### 5-1-3. H.DRIVE Circuit

The horizontal pre-drive pulse comes from PWE-317A (H.OSC UNIT) PIN ⑥ to Q503 via Q501 and Q502. Q504 provides the energy to T501. This energy is regulated by Q504 to compensate for Q505 power loss. Q504's collector voltage is controlled by both H.F/V and H. size voltage. The relationship of Q504 collector voltage, H F/V voltage and H. size voltage is shown Fig. 5-1-6.



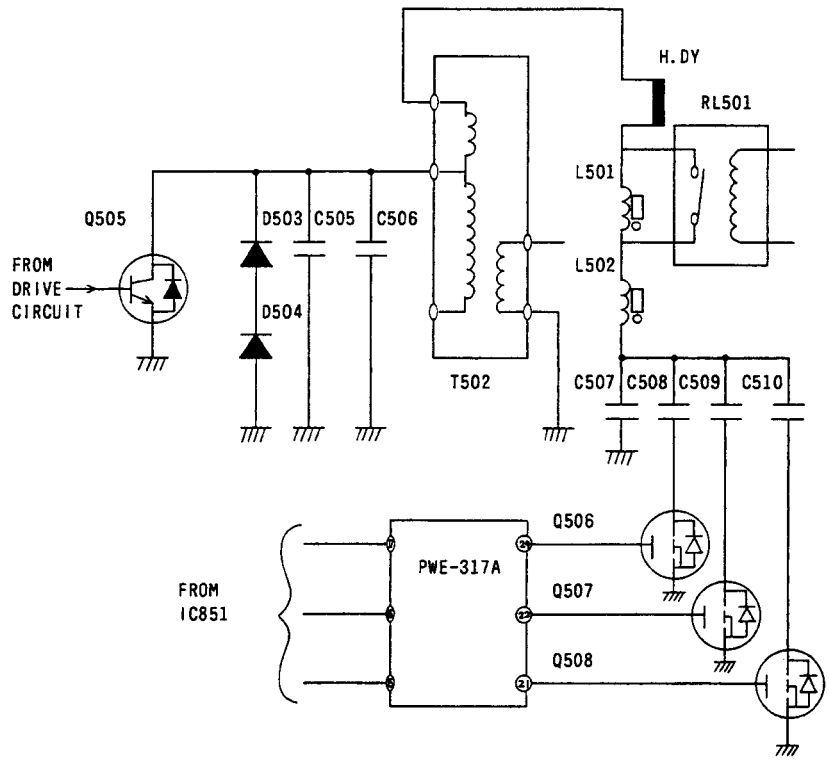

(Fig. 5-1-5) H.Drive circuit




(Fig. 5-1-6) The Relationship Q504 collector voltage, H F/V voltage and H.SIZE voltage

### 5-1-4. H.OUTPUT Circuit

The signal from T501 turns on and off the horizontal output transistor Q505. Consequently, Q505 is turned alternately on and off so that the SAW TOOTH current flows into the horizontal deflection yoke. The H.band signals from IC851 input to GATE of Q506, Q507 and Q508 via PWE-317A. Consequently "S" capacitors (Z507, C508, C509, and C510) are rearranged by H. frequency bands. The relationship of signals from PWE-317A, H. frequency and "S" capacitors is as Fig. 5-1-8. L501 and L502 are Linearity coils. If horizontal frequency is higher than 38kHz, L501 is shortedby by RL501. The 4FG has several types of CRTs. L501, L502, C505 and C506 values are determined by the type of CRT.




(Fig. 5-1-7) H. OUTPUT Circuit

| H.FREQUENCY | Q506 GATE | Q507 GATE | Q508 GATE | C507 | C508 | C509 | C510 |
|---|---|---|---|---|---|---|---|
| 52 kHz to 58 kHz | L | L | L | ON | OFF | OFF | OFF |
| 46 kHz to 52 kHz | H | L | L | ON | ON | OFF | OFF |
| 42 kHz to 46 kHz | L | H | L | ON | OFF | ON | OFF |
| 37 kHz to 42 kHz | H | H | L | ON | ON | ON | OFF |
| 34 kHz to 37 kHz | L | L | H | ON | OFF | OFF | ON |
| 32 kHz to 34 kHz | H | L | H | ON | ON | OFF | ON |
| 30 kHz to 32 kHz | L | H | H | ON | OFF | ON | ON |
| 27 kHz to 30 kHz | H | H | H | ON | ON | ON | ON |

L=LOW
H=HIGH

(Fig. 5-1-8) The relationship of H. frequency, Signals from PWE-317A and "S" capacitor

| CRT | M36KME20XX19 (T0)<br>M36KME23XX19 (T3)<br>M36KME23XX19 (T3) (R)<br>M36KME20XX21 (T0)<br>M36KME23XX21 (T3) | M36KLH690X14<br>M36KLH680X14<br>M36KLH680X14 (R) |
|---|---|---|
| L501 | M515 (60919119) | N516 (60919120) |
| L502 | M516 (60919120) | N514 (69019118) |
| C505 | CF92P1.4KV302HB (42817002) | CF93P1.4KV252HB (42817001) |
| C510 | CF93P2G754JBW (42839331) | CF93P2G684JBW (42899043) |

(Fig. 5-1-9) The relationship two types of CRTs, L501, L502, C505 and C510

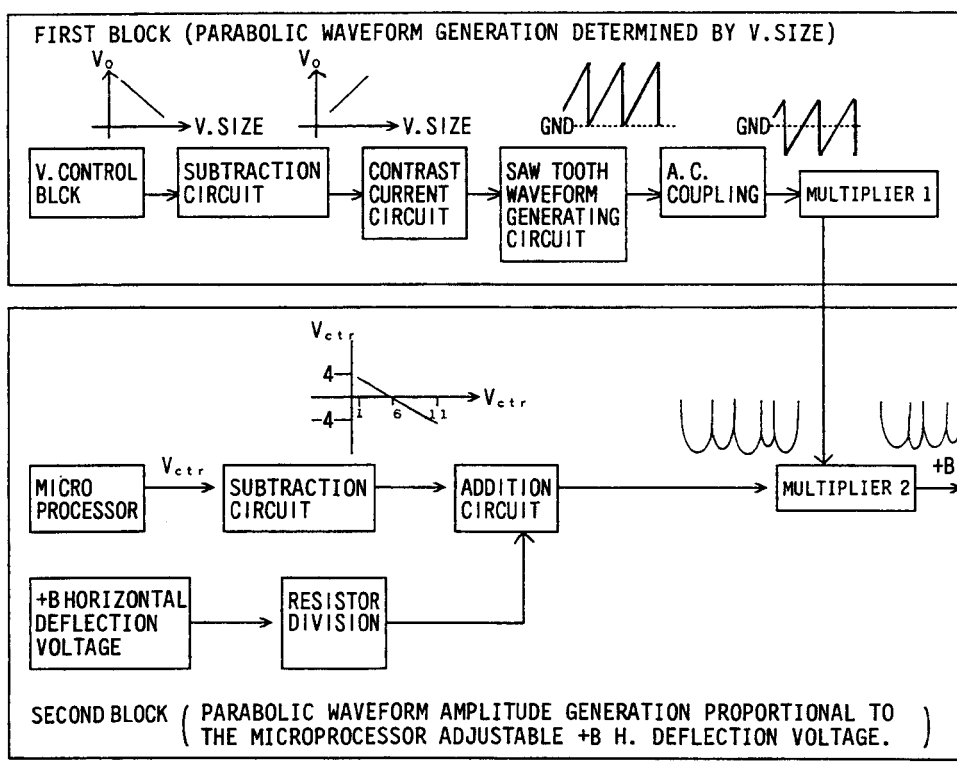
### 5-1-5. Parabola Waveform Generating Circuit

The parabola wavefrom generating circuit consists mainly of two blocks (See Fig. 5-1-10 and Fig. 5-1-11) Each block includes a multiplier which has two input terminals. In the first block, a parabolic waveform is generated from the saw tooth wave. The saw tooth wave is generated as shown below. The vertical control block diagram shows that the linear V. size voltage is supplied a PIN ⑤. The linear relation is transformed into a proportional relation by means of the subtraction circuit composed of R4H4, R4H5, R4H6, R4H7, R4H8, C4E8 and C4E9. By using this voltage, the constant current circuit composed of R4H3 and Q4E2, and the saw tooth waveform circuit composed of Q4E1, R4H1, R4H2, C4E7 and ZD4E1 generates the straight saw tooth waveform at the connected point of R4H2 and C4E7. This voltage is proportional to the vertical size. The saw tooth waveform is A.C. coupled by C4F3.

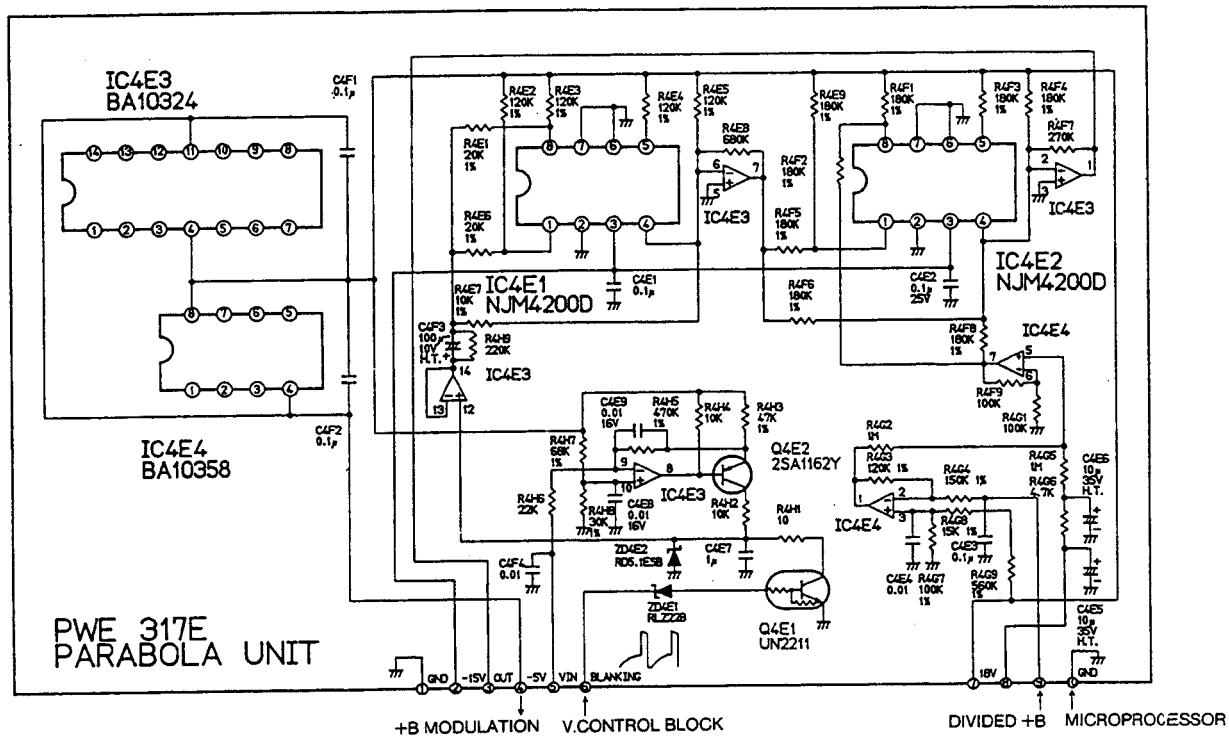
The multiplier of IC4E1 squares the A.C. coupled saw tooth waveform and outputs parabolic waveform from PIN ⑦ of IC4E3. The amplitude of the parabola waveform has to be proportional to the +B voltage of H. deflection. In the second block, the transaction of making the amplitude of the parabola waveform proportional to the +B voltage of H. deflection and making the amplitude is user control adjustable by user control is conducted. +B voltage of H. deflection is divided by R409 and VR403.

The parabola wave and the H. deflection +B are input from each terminal of multipliers 2. User control adds to subtracts from the divided +B H. deflection voltage from the microprocessor through the R4F9,R4G1 and an OP amp. The positive or negative user control voltage is obtained transforming the control voltage from microprocessor by means of subtraction circuit composed of R4G3, R4G4, R4G7, R4G8, R4G9, C4E3, C4E4 and an OP amp. The +B H. deflection voltage veries as the H. frequency varies. Necessary range of control voltage is also proportional to the +B H. deflection voltage. So in order to keep the variable guantity of the side pin cushion correction not so different at any frequency, the range of control voltage is different at each four band of horizontal frequency.

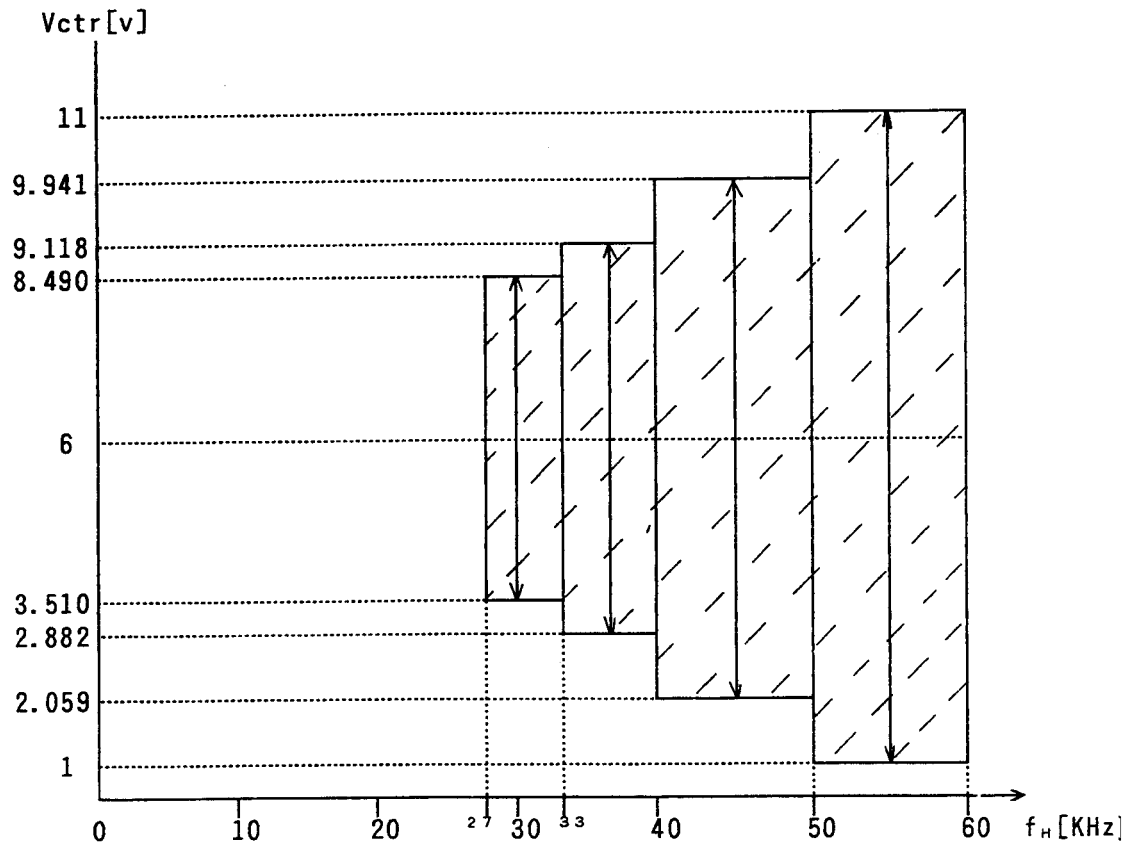
With using above method, the last parabolic wave is output from PIN ① of IC4E1.




(Fig. 5-1-10) The BLOCK DIAGRAM OF PARABOLA WAVEFORM GENERATING CIRCUIT




(Fig. 5-1-11) The SCHEMATIC DIAGRAM OF PARABOLA WAVEFORM GENERATING CIRCUIT

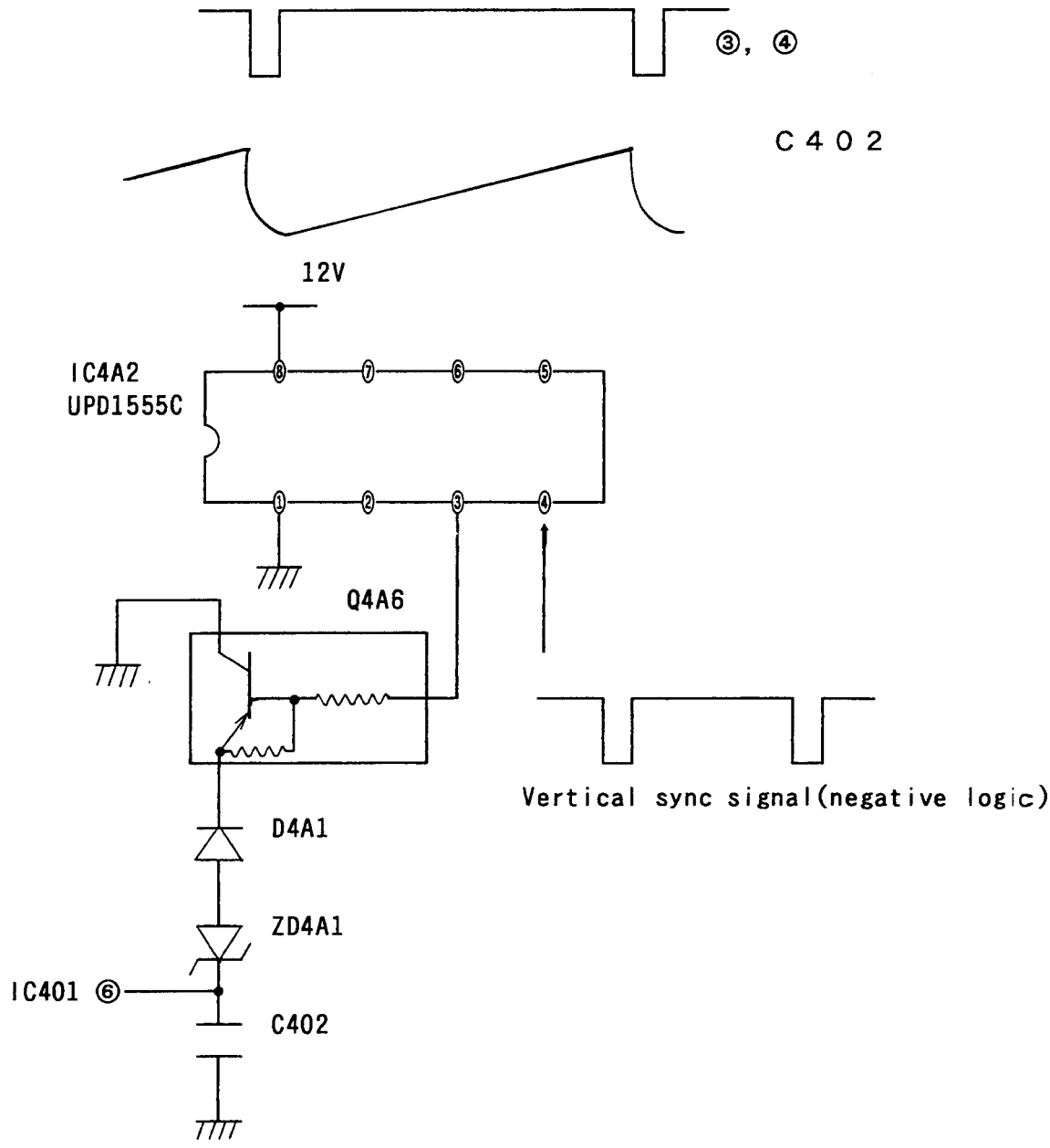



(Fig 5-1-12) H.FREQUENCY VS CONTROL VOLTAGE OF MICROPROCESSOR

## 5-2. Vertical System

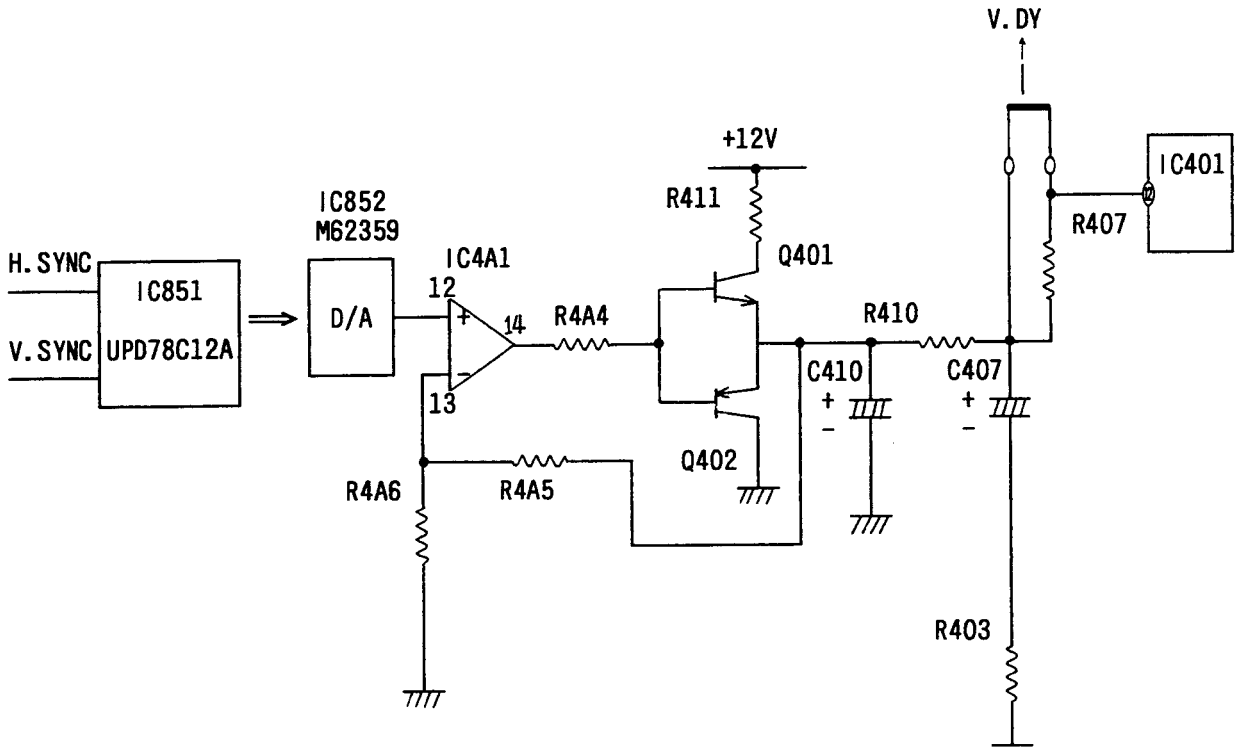
### 5-2-1. Vertical synchronization Circuit

IC4A2 (UPC1555C) is a Multi Vibrator. Sync output is obtained at IC4A2 PIN ③ resetting the Multi-Vibrator. Reset is conducted by inputing the vertical sync signal (negative logic) to IC4A2 PIN ④. where direct current flows in the Vertical Sise Control circuit and is discharged when IC4A2 PIN ③ is Low.




(Fig. 5-2-1) Vertical synchronization Circuit

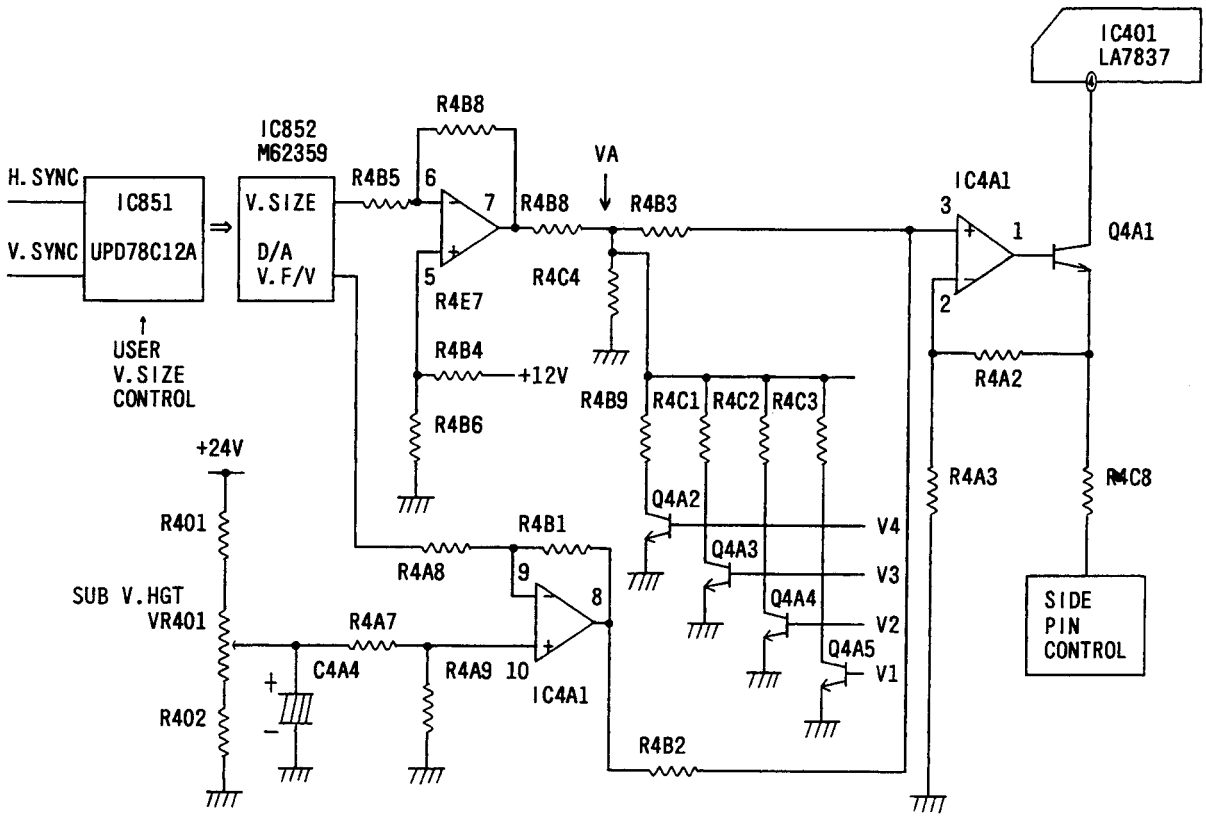
**5-2-2. V. Position Circuit**




(Fig. 5-2-2) BLOCK DIAGRAM of V.Position Circuit

The V. position control voltage (Output of IC4A1) manipulates the push-pull transistors (Q401 and Q402) output DC level and also the V DY DC biasing current.

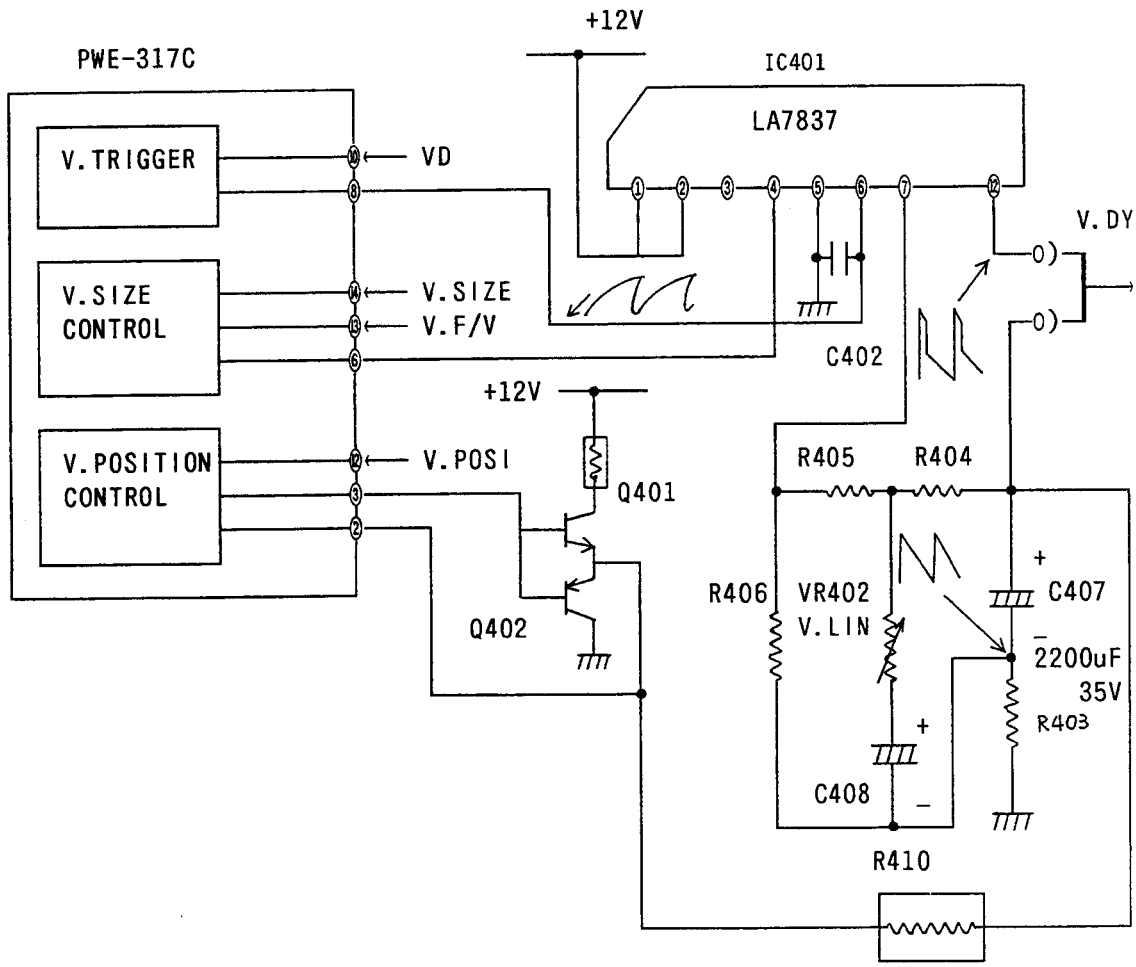
### 5-2-3. V. Size Circuit




(Fig. 5-2-3) BLOCK DIAGRAM of V.SIZE Circuit

The vertical raster size is controlled by the sink current of IC401 PIN ④ (collecter current of Q4A1). Therefore,it can be controlled by changing the DC base voltage of Q4A1. The parameters which decide the vertical video size are the vertical frequency and V. size control voltage. To keep constant vertical raster size, the V F/V (Output of IC852) output signal controls the Q4A1 base voltage. And, to also keep this vertical raster size constant for the pre-set signals, the V. size control voltage (Output of IC852) controls the base voltage of Q4A1. VR01 (SUB V.Hght) specifies the maxmum vertical size. To keep the vertical range for the vertical frequency, the variable range of VA will be changed by Q4A2~Q4A5.

### 5-2-4. Vertical output circuit




(Fig. 5-2-4) BLOCK-DIAGRAM Vertical output Circuit

The Vertical deflection circuit produces a Saw Tooth current wavefrom for the Vertical DY. The output of IC401 (LA7837) is suited for multi-scanning monitors because it easily controls the Vertical size (by DC control) and is also easy to Synchronize. By controlling IC401 (LA7837) with the former explained Vertical Amplitude circuit and Vertical Sync circuit,the Saw Tooth Wave current goes into the Deflection Yoke from the IC401 PIN ⑫. The Saw Tooth Wave can be detected at both ends of the R403 in proportion to the Vertical deflection current. The feedback network of R404, R405, VR406 and R402 to operate V. linearity control and V. size control.

# TROUBLE SHOOTING

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# 1. NO RASTER

**Check The 150V Line**
**Check The 80V Line**

Measure the voltage between CN-K① and Ground and CN-K② and Ground on the Switching Regulator Unit when the CN-K is disconnected. The 150V line greater than 150V and the 80V line will approximately 80V and the 24V line should be approximately 24.

Failed → **Check The Switching Regulator Unit (Item 12)**

Passed

**Check The 150V Line**
**Check The 80V Line**
**Check The 24V Line**

Measure the voltage between CN-K① and Ground, CN-K② and Ground, and CN-K③ and Ground on the Main PWB (PWE-314A) when the CN-K is connected to the Switching Regulator Unit. The 150V line should be approximately 150V and the 80V line should be approximately 80V and the 24V line should be approximately 24.

Failed → For the 150V Line, C541, C521, D508, Q510, Q505, D509, C522, D557, D503, or D504 may have failed.
For the 80V Line C762, or IC703 may have failed.
For the 24V Line C517, IC553, C404, IC401, IC4A1, C553, IC551, or Q509 may have failed.

Passed

**Check The CRT Heater Voltage**

Failed → For the CRT Heater Line C558, C557, C899, IC864, C561, IC552, or C562 may have failed. Also, refer to Item6 (The Low −B Chopper Control Circuit).

Passed

**Check The High Voltage Operation**

Measure the High Voltage.
**Caution:** The High Voltage for this unit will average between 22.5KV to 25.5KV.

Failed → **Check The High Voltage Circuit. Refer To Item 3.**

Passed

**Turn The Screen Control On The FBT slowly clockwise**

Measure the Screen Voltage on the CRT PWB (PWE-315B). The voltage should be approximately 250V to 900V.

Failed → Voltage is too low. T503, the CRT Socket, or the CRT may have failed.

Passed → The CRT may have failed.

## 2. ABNORMAL IMAGE OR RASTER BRIGHTNESS (Too Dark or Too Bright)

**Check The R, G, B Video Outputs**
Check the waveforms at TP901R, TP902G, and TP903B on the CRT PWB (PWE-315B) with an all white pattern applied to the unit.

Failed → **Check The Clamp Pulse**
Check the waveforms at TP901R, TP902G, and TP903B on the CRT PWB (PWE-315B). Make certain that the clamp pulse voltage is approximately 10 volt peak to peak. When and all black pattern is applied to the unit.

Failed → **Check The Sync Inputs**
Check the waveforms at pins ⑥ and ⑧ of IC801 on the VIDEO PWB (PWE-315A).

Failed → D704, D705, D711, D712, LC802, LC803, Q801, Q802 or the Signal Cable may have failed.

Passed → IC801, LC850, LC802, IC856, CN-A, or IC851 may have failed.

Passed → **Check The Video Waveforms**
Check the waveforms at IC701 ㉔, ⑳, and ⑯ in the PWB (PWE-315A). The relationship between these three voltages should be approximately the same.

Passed → For incorrect waveform at TP901R: IC703, Q75OR, Q78OR, or Q781R may have failed. For incorrect waveforms at TP902G and TP903B, the above mentioned parts may have failed with their respective suffix.

Failed

**Check The Contrast Control**
The voltage should decrease at TP901 R, TP902 G, and TP903 B when the Contrast Control is turned counterclockwise and increase when the control is turned clockwise.

Failed → Q721, Q722, IC853, or IC859 may have failed.

Passed → D701, D702, D703 D708, D709, D710, IC703 or IC701 may have failed.

Passed

**Check The R, G, B, Video Outputs**
Make certain that the voltages at TP901R, TP902G, and TP903B on the CRT PWB (PWE-315B) are approximately 85 volts D.C. ±6V for the NEC CRT.

Failed → **Check The 120V Line**
Make certain that the voltage between CN-J① positive lead and CN-J⑩ Ground on the PWB (PWE-315A) is approximately 120 volts.

Failed → CN-J or C786 may have failed.

Passed

**Check The Brightness Control**
The voltage should decrease at TP901R, TP902G, and TP903B when the Brightness Control is turned counterclockwise and increase when it is turned clockwise.

Passed → IC704 may have failed.

Failed → For the incorrect waveform response at TP901R: Q780R, Q781R, or IC704 may have failed. For the incorrect waveform response at TP902G and TP903B, the above parts may have failed with their respective suffix.

**Check The High Voltage Operation**
Measure the High Voltage.
**Caution:** The High Voltage for this unit will average between 22.5KV to 25.5KV.

Failed → **Check The High Voltage Circuit. Refer To Item 3.**

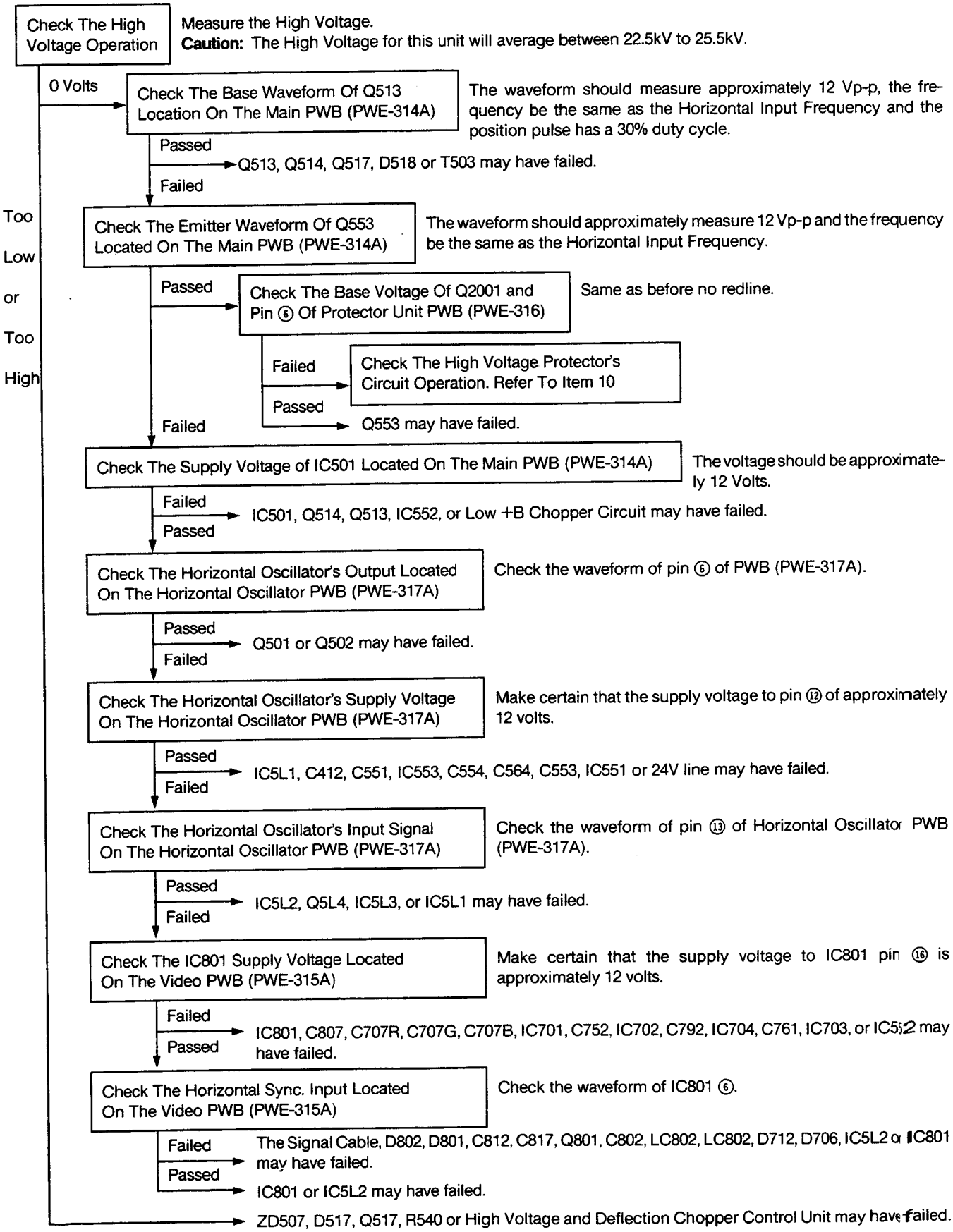
Passed

**Check The Screen Control On the FBT**
Measure the Screen Voltage on the CRT PWB (PWE-315B). The voltage should be approximately 250V to 900V.

Too Low → T503, CRT SOCKET, or the CRT may have failed.

Passed → The CRT may have failed.

# 3. HIGH VOLTAGE FAILURE


Check The High Voltage Operation
Measure the High Voltage.
Caution: The High Voltage for this unit will average between 22.5kV to 25.5kV.
0 Volts
Too Low or Too High
Check The Base Waveform Of Q513 Location On The Main PWB (PWE-314A)
The waveform should measure approximately 12 Vp-p, the frequency be the same as the Horizontal Input Frequency and the position pulse has a 30% duty cycle.
Passed
Q513, Q514, Q517, D518 or T503 may have failed.
Failed
Check The Emitter Waveform Of Q553 Located On The Main PWB (PWE-314A)
The waveform should approximately measure 12 Vp-p and the frequency be the same as the Horizontal Input Frequency.
Passed
Check The Base Voltage Of Q2001 and Pin ⑥ Of Protector Unit PWB (PWE-316)
Same as before no redline.
Failed
Check The High Voltage Protector's Circuit Operation. Refer To Item 10
Passed
Q553 may have failed.
Failed
Check The Supply Voltage of IC501 Located On The Main PWB (PWE-314A)
The voltage should be approximately 12 Volts.
Failed
IC501, Q514, Q513, IC552, or Low +B Chopper Circuit may have failed.
Passed
Check The Horizontal Oscillator's Output Located On The Horizontal Oscillator PWB (PWE-317A)
Check the waveform of pin ⑥ of PWB (PWE-317A).
Passed
Q501 or Q502 may have failed.
Failed
Check The Horizontal Oscillator's Supply Voltage On The Horizontal Oscillator PWB (PWE-317A)
Make certain that the supply voltage to pin ⑫ of approximately 12 volts.
Passed
IC5L1, C412, C551, IC553, C554, C564, C553, IC551 or 24V line may have failed.
Failed
Check The Horizontal Oscillator's Input Signal On The Horizontal Oscillator PWB (PWE-317A)
Check the waveform of pin ⑬ of Horizontal Oscillator PWB (PWE-317A).
Passed
IC5L2, Q5L4, IC5L3, or IC5L1 may have failed.
Failed
Check The IC801 Supply Voltage Located On The Video PWB (PWE-315A)
Make certain that the supply voltage to IC801 pin ⑯ is approximately 12 volts.
Failed
IC801, C807, C707R, C707G, C707B, IC701, C752, IC702, C792, IC704, C761, IC703, or IC5L2 may have failed.
Passed
Check The Horizontal Sync. Input Located On The Video PWB (PWE-315A)
Check the waveform of IC801 ⑥.
Failed
The Signal Cable, D802, D801, C812, C817, Q801, C802, LC802, LC802, D712, D706, IC5L2 or IC801 may have failed.
Passed
IC801 or IC5L2 may have failed.
ZD507, D517, Q517, R540 or High Voltage and Deflection Chopper Control Unit may have failed.

# 4. NO HORIZONTAL DEFLECTION

Check The Horizontal Deflection's +B Supply Voltage Located On The Main PWB (PWE-314A)

Measure the voltage between K1 and Ground. The Voltage should be approximately 150V. If failed refer to Item 12.

Failed → Check The High Voltage and Deflection Chopper Control Circuit. waveform of Located On The H V DEF CHOPPER PWB (PWE-317D)

Passed → Q518, Q519, D506, D507, C520, Q510 or D507 may have failed.

Failed → Check The High Voltage Deflection Chopper Control Unit's Circuit. Refer To Item 7

Passed → The High Voltage Deflection Chopper control Unit or 24 voltage line may have failed.

# 5. NO VERTICAL DEFLECTION

Check The Vertical Deflection Waveform Located On The Main PWB (PWE-314A)

Check the waveform of IC 401 pin ⑫.

Passed → The CRT may have failed.

Failed →

Check The Vertical Deflection IC's Output Power Located On The Main PWB (PWE-314A)

The voltage of IC401 pin ① should be approximately 12 volts pin ⑧ approximately 24 volts.

Failed → C401, C562, IC552, IC401, C404, +24V line, or Low Voltage Chopper Circuit may hve failed.

Passed →

Check The Vertical Drive Pulse Locataed On The Main PWB (PWE-314A)

Check the waveform of pin ⑨ of CN-A.

Failed → IC851, IC5L2, Q403, IC4A2, or Connector CN-A may have failed.

Passed →

Check The Vertical Oscillator's Output Located On The Main PWB (PWE-314A)

Check the waveform of IC 401 pin ⑥.

Failed → IC4A2, IC401, ZD4A1, or D4A1 may have failed.

Passed →

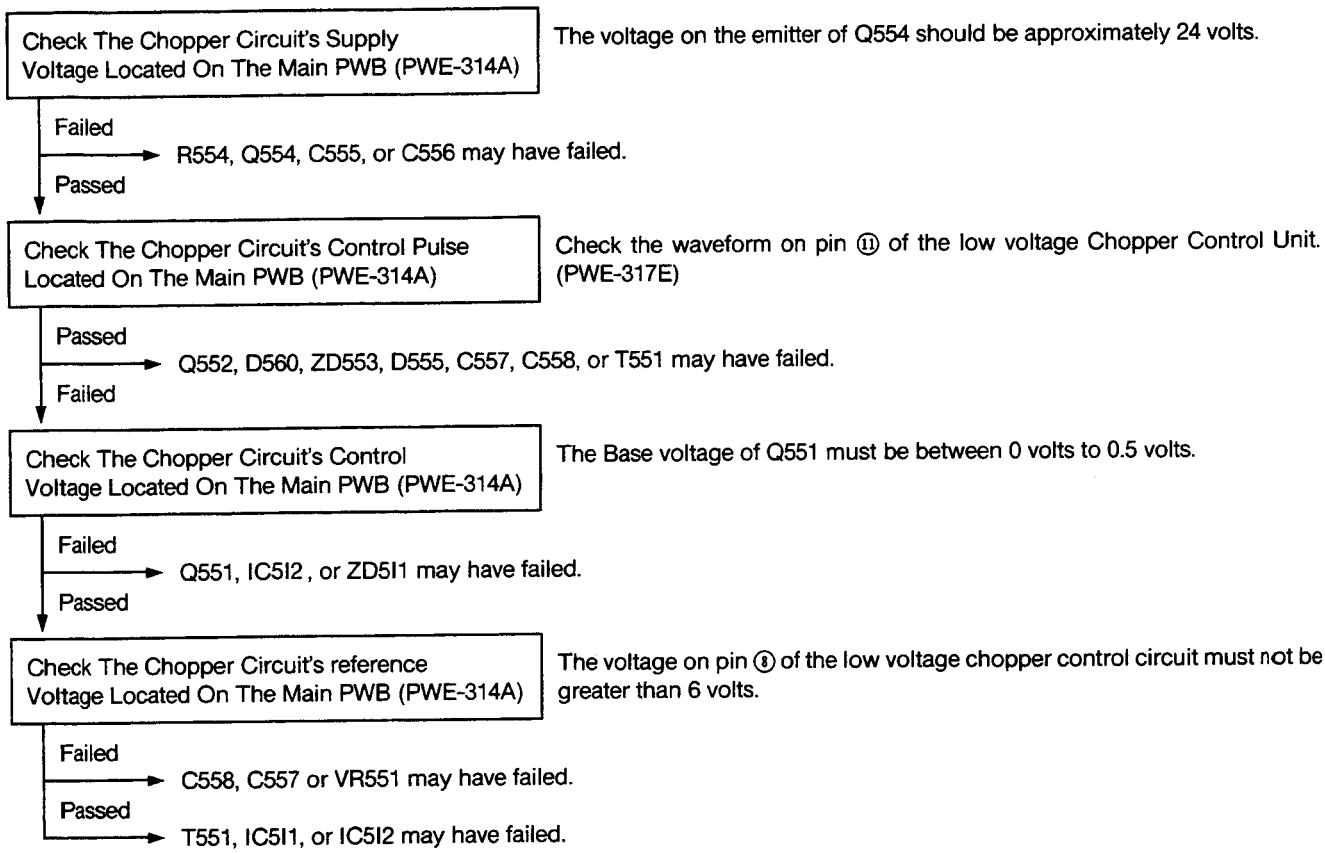
Check The Vertical Oscillator's Supply Voltage Located On The Vertical Control Unit PWB (PWE-317C)

The voltage on pin ⑤ of this PWB should be approximately 12 volts pin ⑨ should be 24 volts.

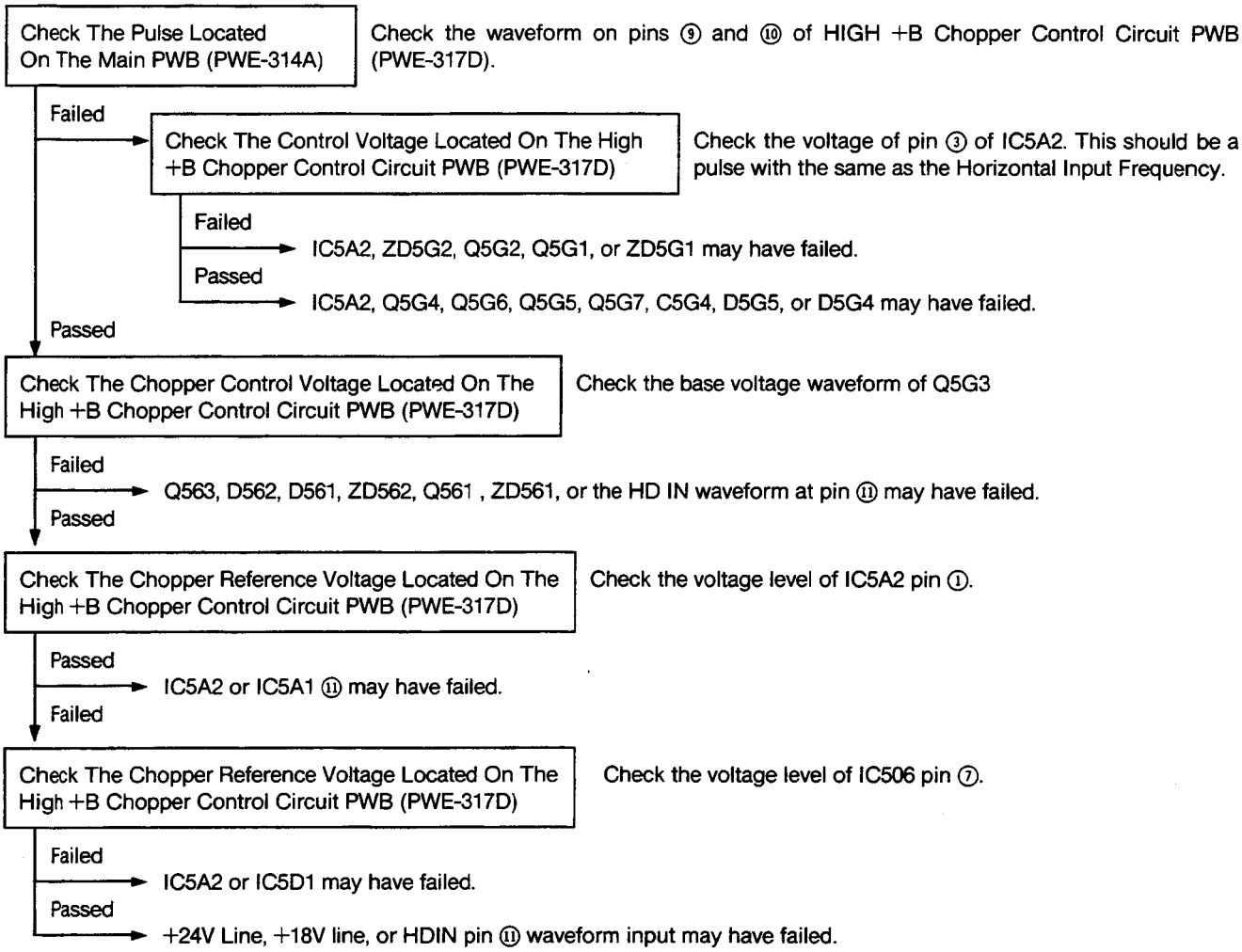
Failed → IC4A1, IC4A2, Low voltage chopper control unit, or the 24 volt line may have failed.

Passed → IC401 may have failed.

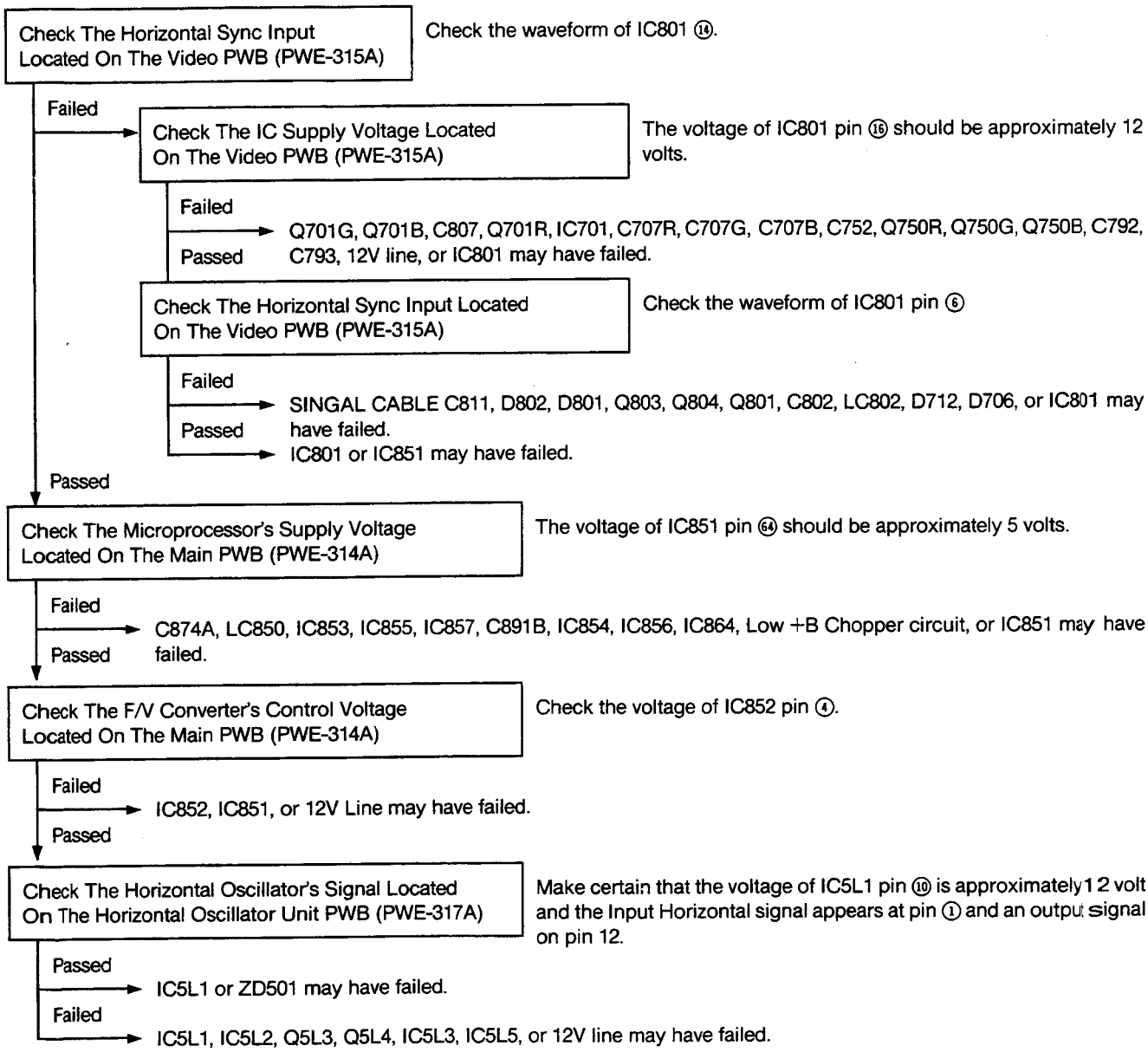
# 6. LOW +B CHOPPER CONTROL CIRCUIT OR THE HEATER SUPPLY VOLTAGE FAILURE


Check The Chopper Circuit's Supply Voltage Located On The Main PWB (PWE-314A)
The voltage on the emitter of Q554 should be approximately 24 volts.
Failed
R554, Q554, C555, or C556 may have failed.
Passed
Check The Chopper Circuit's Control Pulse Located On The Main PWB (PWE-314A)
Check the waveform on pin ⑪ of the low voltage Chopper Control Unit. (PWE-317E)
Passed
Q552, D560, ZD553, D555, C557, C558, or T551 may have failed.
Failed
Check The Chopper Circuit's Control Voltage Located On The Main PWB (PWE-314A)
The Base voltage of Q551 must be between 0 volts to 0.5 volts.
Failed
Q551, IC5I2, or ZD5I1 may have failed.
Passed
Check The Chopper Circuit's reference Voltage Located On The Main PWB (PWE-314A)
The voltage on pin ⑧ of the low voltage chopper control circuit must not be greater than 6 volts.
Failed
C558, C557 or VR551 may have failed.
Passed
T551, IC5I1, or IC5I2 may have failed.

# 7. HIGH +B CHOPPER CONTROL CIRCUIT OR THE +B FOR THE HIGH VOLTAGE OR DEFLECTION CIRCUIT FAILURE


Check The Pulse Located On The Main PWB (PWE-314A)
Check the waveform on pins ⑨ and ⑩ of HIGH +B Chopper Control Circuit PWB (PWE-317D).
Failed
Check The Control Voltage Located On The High +B Chopper Control Circuit PWB (PWE-317D)
Check the voltage of pin ③ of IC5A2. This should be a pulse with the same as the Horizontal Input Frequency.
Failed
IC5A2, ZD5G2, Q5G2, Q5G1, or ZD5G1 may have failed.
Passed
IC5A2, Q5G4, Q5G6, Q5G5, Q5G7, C5G4, D5G5, or D5G4 may have failed.
Passed
Check The Chopper Control Voltage Located On The High +B Chopper Control Circuit PWB (PWE-317D)
Check the base voltage waveform of Q5G3
Failed
Q563, D562, D561, ZD562, Q561 , ZD561, or the HD IN waveform at pin ⑪ may have failed.
Passed
Check The Chopper Reference Voltage Located On The High +B Chopper Control Circuit PWB (PWE-317D)
Check the voltage level of IC5A2 pin ①.
Passed
IC5A2 or IC5A1 ⑪ may have failed.
Failed
Check The Chopper Reference Voltage Located On The High +B Chopper Control Circuit PWB (PWE-317D)
Check the voltage level of IC506 pin ⑦.
Failed
IC5A2 or IC5D1 may have failed.
Passed
+24V Line, +18V line, or HDIN pin ⑪ waveform input may have failed.

# 8. UNSTABLE HORIZONTAL SYNCHRONIZATION


Check The Horizontal Sync Input Located On The Video PWB (PWE-315A)
Check the waveform of IC801 ⑭.
Failed
Check The IC Supply Voltage Located On The Video PWB (PWE-315A)
The voltage of IC801 pin ⑯ should be approximately 12 volts.
Failed
Q701G, Q701B, C807, Q701R, IC701, C707R, C707G, C707B, C752, Q750R, Q750G, Q750B, C792,
Passed
C793, 12V line, or IC801 may have failed.
Check The Horizontal Sync Input Located On The Video PWB (PWE-315A)
Check the waveform of IC801 pin ⑥
Failed
SINGAL CABLE C811, D802, D801, Q803, Q804, Q801, C802, LC802, D712, D706, or IC801 may
Passed
have failed.
IC801 or IC851 may have failed.
Passed
Check The Microprocessor's Supply Voltage Located On The Main PWB (PWE-314A)
The voltage of IC851 pin ⑭ should be approximately 5 volts.
Failed
C874A, LC850, IC853, IC855, IC857, C891B, IC854, IC856, IC864, Low +B Chopper circuit, or IC851 may have
Passed
failed.
Check The F/V Converter's Control Voltage Located On The Main PWB (PWE-314A)
Check the voltage of IC852 pin ④.
Failed
IC852, IC851, or 12V Line may have failed.
Passed
Check The Horizontal Oscillator's Signal Located On The Horizontal Oscillator Unit PWB (PWE-317A)
Make certain that the voltage of IC5L1 pin ⑩ is approximately1 2 volt and the Input Horizontal signal appears at pin ① and an output signal on pin 12.
Passed
IC5L1 or ZD501 may have failed.
Failed
IC5L1, IC5L2, Q5L3, Q5L4, IC5L3, IC5L5, or 12V line may have failed.

## 9. UNSTABLE VERTICAL SYNCHRONIZATION

Check The Vertical Input Output Located On The Video PWB (PWE-315A) — Check the waveform of IC801 pin ⑧ and pin ⑬.

Failed → IC801, 12V line, C814, Q802, LC803, JC851, D713, D707 or IC5L2 may have failed.

Passed

Check The Vertical Control Unit. Input Located On The Vertical PWB Control Unit (PWE-317C) — Check the waveform of pin ⑧ of Vertical Control Unit.

Failed → D4A1, ZD4A1, IC4A2, or 12V line may have failed.

Passed → IC401, 24V line, or IC4A1 may have failed.

## 10. HIGH VOLTAGE PROTECTORS INCORRECT OPERATION OR FAILURE

**CAUTION:** When the High Voltage circuit is operating, the Horizontal Deflection Circuit is also operating. Therefore, the collector of Q505 has a high voltage pulse of an average value of 900 Vp-p.

Check the following items before manually operating the High Voltage Protector Circuits. The High Voltage Protector Circuits need a few seconds after the power has been turned OFF to reset.

Check The High Voltage Detection Circuit's Voltage Located On The Main PWB (PWE-314A) — Check the voltage of TP-A ⑦ and ⑨.

Failed → Check The Operation Of The High Voltage Circuit. Refer To Item 3.

Passed → R536, D2005, C2001, C2002, R537, or D2004 may have failed.

Passed

Check The High Voltage Protector's Operating Voltage Located On The High Voltage Protector PWB (PWE-316) — Check the base voltage of Q2002.

Failed → Q2002, Q2001, or ZD2002 may have failed.

Passed → IC5L1, ZD2002, or D2002 may have failed.

# 11. SIDE PIN CUSHION FAILURE

The following can be used when the Side Pin Cushion Control In Mode 2 is not operating properly or the Side Pin Cushion Control level is not enough:

Check The Side Pin Cushion Waveform Located On The Parabola PWB (PWE-317E)

Check the parabolic waveform on pin ③.

Passed → C5D4 or IC5D1 may have failed.

Failed

Check The Side Pin Cushion Waveform Located On The Parabola PWB (PWE-317E)

Check the parabolic waveform of IC4E2 pin ④.

Passed → IC4E3 or IC4E2 may have failed.

Failed

Check The Side Pin Cushion Waveform Located On The Parabola PWB (PWE-317E)

Check the parabolic waveform of IC4E2 pin ①.

Passed → IC4E2 may have failed.

Failed

Check The Side Pin Cushion Waveform Located On The Parabola PWB (PWE-317E)

Check the parabolic waveform of IC4E2 pin ④.

Passed → IC4E3 may have failed.

Failed

Check The Side Pin Cushion Waveform Located On The Parabola PWB (PWE-317E)

Check the Sawtooth waveform of IC4E3 pin ⑭.

Passed → IC4E3 or C4F3, or IC4E1 may have failed.

Failed

Check The Side Pin Cushion Supply Voltages Located On The Parabola PWB (PWE-317E)

The voltage of pin ② of parabolic PWB (PWE-317E) should be −15 volts, pin ④ be −5 volts, and pin ⑦ be +18 volts.

Passed → Check the Low +B chopper circuit refer to Item 6.

Failed

Check The Side Pin Cushion Control Voltage Located On The Parabola PWB (PWE-317E)

Check the Blanking Input or pin ⑥ of the parabola PWB (PWE-317E).

Failed → Q4E1, ZD4E1, ZD401, or IC401 may have failed.

Passed

Check The Side Pin Cushion Control Voltage Located On The Parabola PWB (PWE-317E)

The voltage of pin ⑨ of the parabola PWB (PWE-317E). Should change with the change of the side pin Cushion Control.

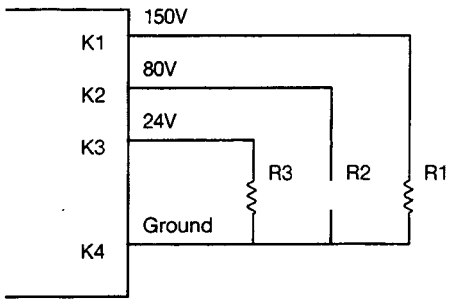
Passed → IC4E4 have failed.

Failed → IC4E4, IC4E2, IC852, or IC851 may have failed.

# 12. SWITCHING REGULATOR POWER SUPPLY UNIT FAILURE

The following can be used either for unstable power output or no output at all:

Before this Troubleshooting section is used the power supply should be turned OFF. Disconnection the CN-K connector and connect the Dummy Load Resistors with the proper rating value shown below. Wait for a minimum of 60 seconds before turning the unit ON again.




| | | | |
|---|---|---|---|
| K1 | 150V | R1 | 80mA2.6KΩ ±10% 40W |
| K2 | 80V | R2 | 0A OPEN |
| K3 | 24V | R3 | 0.6A33Ω ±10% 43W |

Rated Load Current And Resistor Value

Check The Output Voltage Level Of The Power Supply

CN-K pin ① voltage should be 150 volts ±5%.
CN-K pin ② voltage should be 80 volts ±1%.
CN-K pin ③ voltage should be 24 volts ±5%.

Passed → Check other circuits.

Failed

Check The Input Voltage Level Of The Power Supply

The input voltage should be A.C. 110 (A ver.)/A.C. 220 (B ver.) volts thru 120 (A ver.)/240 (B ver.) volts at either 50 Hz or 60 Hz.

Failed → The power cable may be disconnected or may have failed.

Passed

Check The Condition Of The Fuse Located On The Power Supply

F601 should not be blown, open, or deleted.

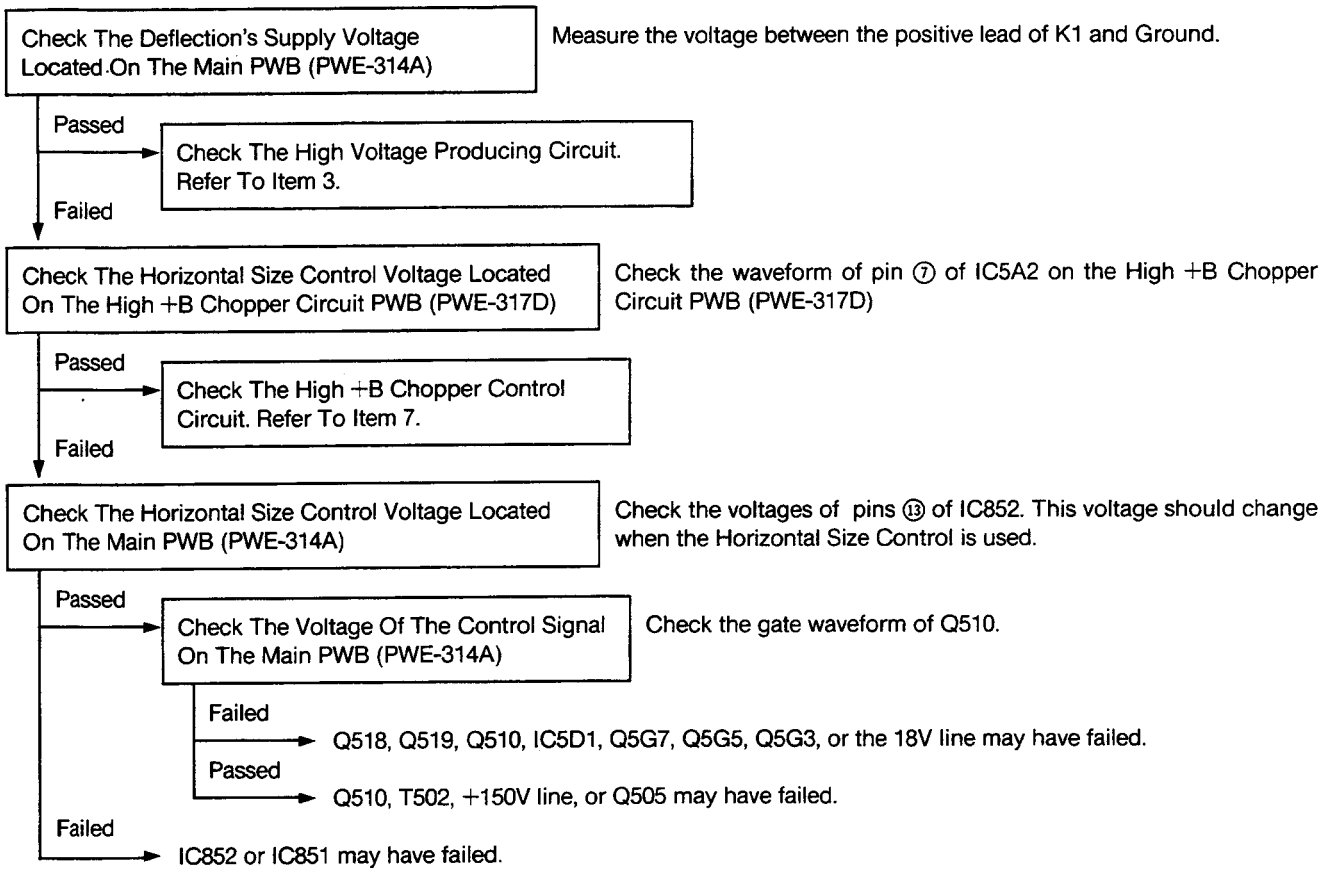
Open → Replace The Fuse

After waiting longer than 60 seconds, replace the fuse, with the correct type and rated fuse, and turn the power ON.

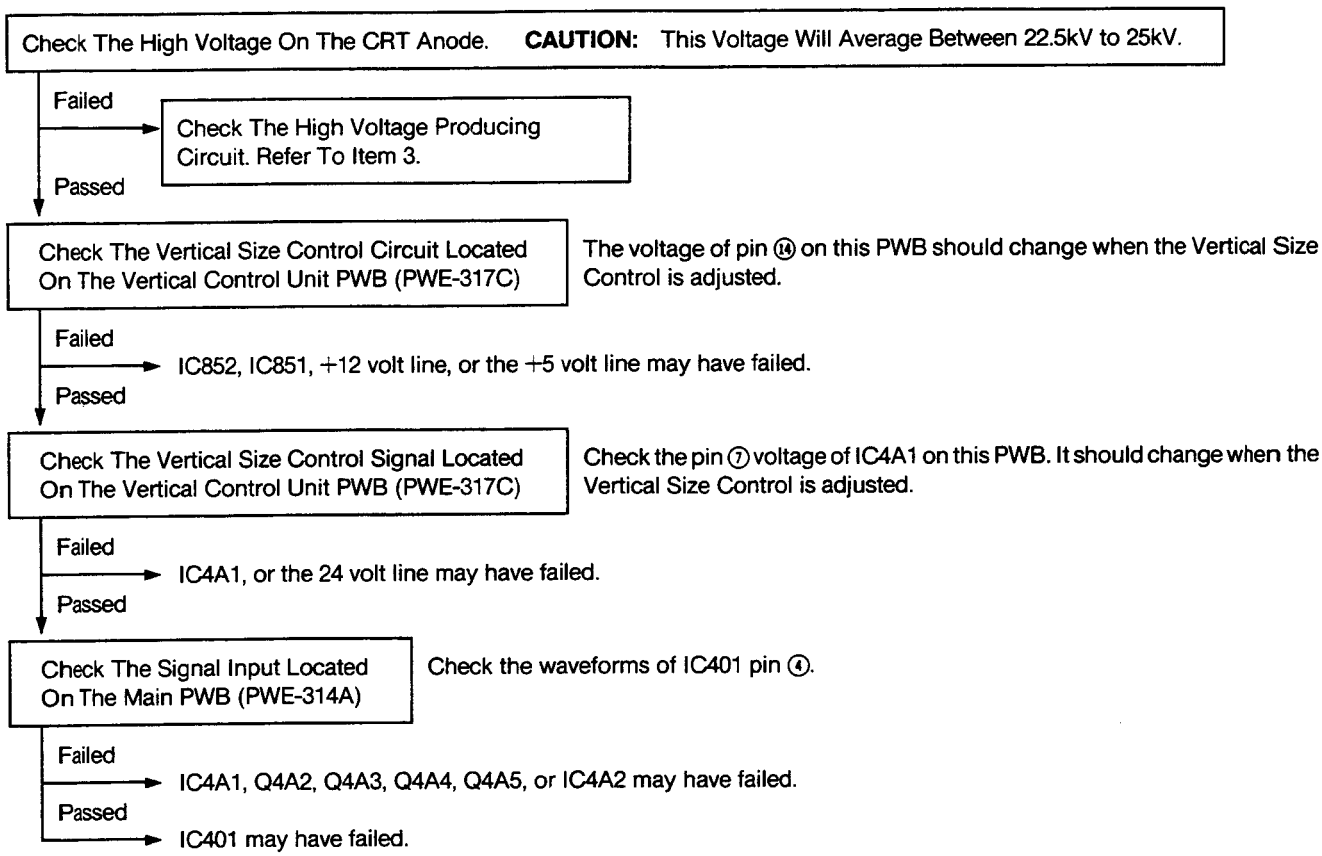
Opened Again → Passed → The output may have been shorted during troubleshooting.

Short → Replace the Power Supply Unit. Due to D.H.H.S requirements, do not repair the unit.

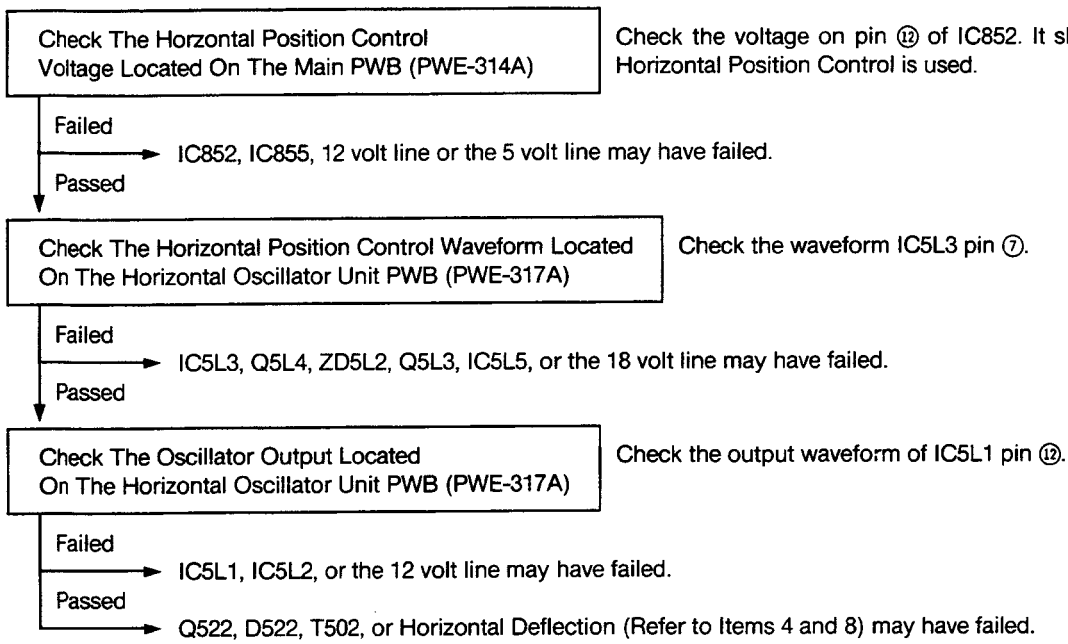
# 13. HORIZONTAL IMAGE SIZE FAILURE OR ABNORMAL FUNCTION


Check The Deflection's Supply Voltage Located On The Main PWB (PWE-314A)
Measure the voltage between the positive lead of K1 and Ground.
Passed
Check The High Voltage Producing Circuit. Refer To Item 3.
Failed
Check The Horizontal Size Control Voltage Located On The High +B Chopper Circuit PWB (PWE-317D)
Check the waveform of pin ⑦ of IC5A2 on the High +B Chopper Circuit PWB (PWE-317D)
Passed
Check The High +B Chopper Control Circuit. Refer To Item 7.
Failed
Check The Horizontal Size Control Voltage Located On The Main PWB (PWE-314A)
Check the voltages of pins ⑬ of IC852. This voltage should change when the Horizontal Size Control is used.
Passed
Check The Voltage Of The Control Signal On The Main PWB (PWE-314A)
Check the gate waveform of Q510.
Failed
Q518, Q519, Q510, IC5D1, Q5G7, Q5G5, Q5G3, or the 18V line may have failed.
Passed
Q510, T502, +150V line, or Q505 may have failed.
Failed
IC852 or IC851 may have failed.

# 14. VERTICAL IMAGE SIZE FAILURE OR ABNORMAL OPERATION


Check The High Voltage On The CRT Anode. CAUTION: This Voltage Will Average Between 22.5kV to 25kV.
Failed
Check The High Voltage Producing Circuit. Refer To Item 3.
Passed
Check The Vertical Size Control Circuit Located On The Vertical Control Unit PWB (PWE-317C)
The voltage of pin ⑭ on this PWB should change when the Vertical Size Control is adjusted.
Failed
IC852, IC851, +12 volt line, or the +5 volt line may have failed.
Passed
Check The Vertical Size Control Signal Located On The Vertical Control Unit PWB (PWE-317C)
Check the pin ⑦ voltage of IC4A1 on this PWB. It should change when the Vertical Size Control is adjusted.
Failed
IC4A1, or the 24 volt line may have failed.
Passed
Check The Signal Input Located On The Main PWB (PWE-314A)
Check the waveforms of IC401 pin ④.
Failed
IC4A1, Q4A2, Q4A3, Q4A4, Q4A5, or IC4A2 may have failed.
Passed
IC401 may have failed.

# 15. ABNORMAL HORIZONTAL IMAGE POSITION FAILURE


Check The Horzontal Position Control Voltage Located On The Main PWB (PWE-314A)
Check the voltage on pin ⑫ of IC852. It should change when the Horizontal Position Control is used.
Failed
IC852, IC855, 12 volt line or the 5 volt line may have failed.
Passed
Check The Horizontal Position Control Waveform Located On The Horizontal Oscillator Unit PWB (PWE-317A)
Check the waveform IC5L3 pin ⑦.
Failed
IC5L3, Q5L4, ZD5L2, Q5L3, IC5L5, or the 18 volt line may have failed.
Passed
Check The Oscillator Output Located On The Horizontal Oscillator Unit PWB (PWE-317A)
Check the output waveform of IC5L1 pin ⑫.
Failed
IC5L1, IC5L2, or the 12 volt line may have failed.
Passed
Q522, D522, T502, or Horizontal Deflection (Refer to Items 4 and 8) may have failed.

# 16. USER CONTROL FAILURE

## 16-1. BRIGHTNESS USER CONTROL FAILURE

Check The Brightness Control Voltage Located On The Main PWB (PWE-314A)

The voltages on IC854 pins ①, ③, and ⑫ should change when the Brightness Control is adjusted.

Failed → IC861, IC854, IC860, or "E" connector may have failed.

Passed

Check The Brightness Control Voltage Located On The Main PWB (PWE-314A)

The voltages on IC854 pins ②, ④, and ⑬ should change when the Brightness Control is adjusted.

Failed → IC854 or IC861 the 5V line may have failed.

Passed

Check The Brightness Control's Operation

- → The Voltages do not change at pin Connector $L_1$, $L_2$, and $L_3$ IC861 or 12 volt line may have failed.
- → The brightness does not change for the Red color Q781R, Q780R, D781R, IC704, or 12 volt line may have failed.
- → The brightness doe not change for the Green color Q781G, Q780G, D781G, IC704, or 12 volt line may have failed.
- → The brightness does not change for the Blue color Q781B, Q780B, D781B, IC704, or 12 volt line may have failed.

## 16-2. CONTRAST USER CONTROL FAILURE

Check The Contrast Control's Voltage Located On The Main PWB (PWE-314A)

The pin of the "E" Connector's voltage should change when the Contrast Control is adjusted.

Failed → IC851, 12 volt line of connector "E" may have failed.

Passed

Check The Contrast Control's Voltage Located On The Main PWB (PWE-314A)

The voltages on IC853 pins ②, ④, and ⑬ should change when the Contrast Control is adjusted.

Failed → IC859, IC853, or the 5 volt line may have failed.

Passed

Check The Pre-Amplifier's Control Voltage Located On The VIDEO PWB (PWE-315A)

The voltages on pins ⑬, ⑰, and ㉑ of IC701 should change when the Contrast Control is adjusted.

Failed → IC701, IC860, IC859, 12 volt lines, or the "C" Connector may have failed.

Passed → IC701, IC702, or 12 volt line may have failed.

## 16-3. HORIZONTAL POSITION CONTROL FAILURE OR ABNORMAL OPERATION

Check The Horizontal Position Control Circuit. Refer To Item 14.

When the Horizontal Position Control Switches (SW104 and SW103) are pressed the voltage or pin ⑫ of IC852 should change.

Failed → SW103, SW104, IC852, 5 volt line, 12 volt line, or IC851 may have failed.

## 16-4. VERTICAL POSITION CONTROL FAILURE OR ABNORMAL OPERATION.

Check The Vertical Position Control Voltage Located On The Mian PWB (PWE-314A)

When the Vertical Position Control Switches (SW105 and SW104) are pressed the voltage pin ⑭ of IC852 should change.

Failed → SW105, SW106, IC852, 5 volt line, 12 volt line, or IC851 may have failed.

Passed → IC4A1, Q401, Q402, 24 volt line, 12 volt line, or IC401 may have failed.

## 16-5. HORIZONTAL SIZE CONTROL FAILURE OR ABNORMAL OPERATION

Check The Horizontal Position Control Voltage Located On The Main PWB (PWE-314A)

The voltage of IC852 pin ⑬ should change when the Horizontal Size Control Switches (SW101 and SW102) are pressed.

Failed → IC852 or 12 volt line may have failed.

Passed

Check The High +B Chopper Control Circuit. Refer To Item 7.

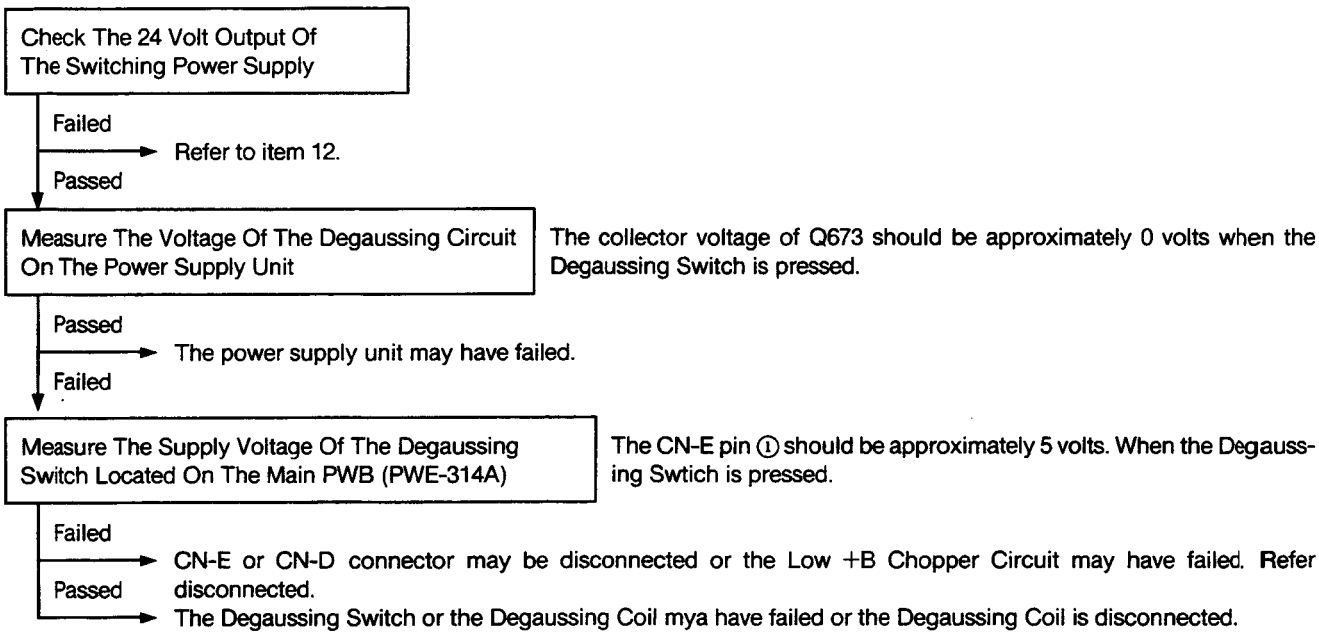
## 16-6. VERTICAL SIZE CONTROL FAILURE OR ABNORMAL OPERATION

IC852, SW105, and SW106, 12 volt line, 24 volt line, IC4A1, Q4A2, Q4A3, Q4A4, Q4A5, IC4A2, or IC401 mya have failed.

## 16-7. SIDE PIN CUSHION CONTROL FAILURE OR ABNORMAL OPERATION

Check the Side Pin Cushion Circuit. Refer to item 11.

## 16-8. MANUAL DEGAUSS SWITCH NOT OPERATIVE


Check The 24 Volt Output Of The Switching Power Supply
Failed
Refer to item 12.
Passed
Measure The Voltage Of The Degaussing Circuit On The Power Supply Unit
The collector voltage of Q673 should be approximately 0 volts when the Degaussing Switch is pressed.
Passed
The power supply unit may have failed.
Failed
Measure The Supply Voltage Of The Degaussing Switch Located On The Main PWB (PWE-314A)
The CN-E pin ① should be approximately 5 volts. When the Degaussing Swtich is pressed.
Failed
CN-E or CN-D connector may be disconnected or the Low +B Chopper Circuit may have failed. Refer disconnected.
Passed
The Degaussing Switch or the Degaussing Coil mya have failed or the Degaussing Coil is disconnected.

# REPLACEMENT PARTS LIST

**Notes:** 1. The components identified by ⚠ mark are critical for safety.
Replace only with parts Number specified.

The components specified for Models JC-1531VMA(N)/(H),(H), (NT)/B(N), B(H), B(NT)/R(N), R(H)/B(EE)(N), B(EE)(H), B(EE)(NT).

| SYMBOL | PARTS NO | DESCRIPTION |
|---|---|---|
| *** CRT & TUNER *** | | |
| ⚠CRT VMA(N) | 33015503 | CRT M36KME20xx19(T0) |
| ⚠CRT VMA(H) | 33015502 | CRT M36KMH690x19 |
| ⚠CRT VMA(NT) | 33015515 | CRT M36KME20xx21(T0) |
| ⚠CRT VMB(N)/VMB(EE)(N) | 33015505 | CRT M36KME23xx19(T3) |
| ⚠CRT VMB(H)/VMB(EE)(H) | 33015504 | CRT M36KLH680x14 |
| ⚠CRT VMB(NT)/VMB(EE)(NT) | 33015516 | CRT M36KME23xx21(T3) |
| ⚠CRT VMR(N) | 33015507 | CRT M36KME23xx19(T3)(R) |
| ⚠CRT VMR(H) | 33015506 | CRT M36KLH680x14(R) |
| *** ICS *** | | |
| IC856 | 370E6005 | IC PST518A |
| IC552 | 37005104 | IC LM2940CT-12 (REG) |
| IC553 IC863 | 37005182 | IC LM7812CT(REG) |
| IC551 | 37005210 | IC UPC24M18HF (REG) |
| IC858 | 37011206 | IC XRA10358 (OP-AMP) |
| IC704 IC859 IC860 IC861 | 37011210 | IC XRA10324 (Q OP-AMP) |
| IC857 | 37052179 | IC SN74LS07N |
| IC501 | 37053337 | MOS XRU4538B (MULTIVIB) |
| IC855 | 37055401 | MOS XRM93C56B-E |
| IC401 | 37056689 | IC LA7837 |
| IC853 IC854 | 37056812 | IC M62362P |
| IC852 | 37056813 | IC M62359P |
| IC701 | 37056814 | IC M52035P |
| IC801 | 37056867 | IC M52036SP |
| IC703 | 37056872 | IC VPS08N |
| IC702 | 37056873 | IC M52013AP |
| IC851 | 37056876 | IC UPD78C12AGQ-A56-36 |
| IC864 | 37903232 | IC LM2940CT-5.0 |
| *** TRANSISTORS *** | | |
| Q511 | 350C1218 | TR 2SB1329-T105 R |
| Q501 Q518 Q520 | 350E3218 | TR 2SC1740S-T R |
| Q551 Q705 Q721 Q770 Q771 | | |
| Q513 | 350E5312 | TR 2SC2001 L AT |
| Q512 | 350G1018 | TR 2SD2005-T105 R |
| Q781B Q781G Q781R | 350H4417 | TR,2SC1473-TA Q |
| Q522 | 350H5017 | TR,2SC3811-TA Q |
| Q401 | 350J2717 | TR 2SC3377-T Q |
| Q701B Q701G Q701R | 350J3016 | TR 2SC2926S-T P |
| Q514 | 350K4412 | TR 2SA952 L,AT |
| Q502 | 350K4517 | TR 2SA933-T Q |
| Q777 Q777 Q801 Q802 | 350K4518 | TR 2SA933-T R |

| SYMBOL | PARTS NO | DESCRIPTION |
|---|---|---|
| Q404 {VMA(NT)/VMB(NT) /VMB(EE)(NT)} | 351G0601 | TR DTC114ES-T |
| Q780B Q780G Q780R | 350K5217 | TR,2SA1018-TA Q |
| Q519 Q521 Q553 | 350K5718 | TR 2SA933S-T R |
| Q504 | 35024812 | TR 2SB536 L |
| ⚠Q505 | 35070100 | TR HPA100 |
| Q750B Q750G Q750R | 35080200 | TR 2SC2407/2407A |
| Q403 Q704 Q805 | 351G0601 | TR DTC114ES-T |
| Q806 | | |
| Q804 | 351G0602 | TR DTC144ES-T |
| Q803 | 351G0652 | TR DTC113ZS-T |
| Q509 Q851 | 351G0656 | TR DTC143XS-T |
| Q552 | 35122100 | TR 2SK703 |
| Q506 Q507 | 35122500 | TR 2SK758 |
| Q503 | 35122700 | TR 2SK699 |
| Q510 Q517 | 35125400 | TR IRF9610 |
| ⚠Q515 | 35125500 | TR IRFPF40 |
| Q508 | 35125700 | TR 2SK947 |
| Q554 | 35501205 | TR 2SB772 E |
| Q402 | 359K7618 | TR 2SA1515 R |
| *** DIODES *** | | |
| ZD554 | 360A0033 | DIODE MTZJ5.1 T-72 |
| ZD501 | 360A0035 | DIODE MTZJ5.1B T-72 |
| ZD760 | 360A0056 | DIODE MTZJ8.2C T-72 |
| ZD401 | 360A0094 | DIODE MTZJ20D |
| ZD507 | 360KC660 | DIODE RD9.1ESB(3)-T1 |
| D101 D102 D103 D104 D105 D106 D107 D108 D109 D110 D111 D112 D113 D114 D115 D116 D402 D403 | 360K1027 | DI 1SS132 AT52 |
| ⚠D505 D506 D507 D517 D522 D523 D555 D556 D701 D702 D703 D704 D705 D706 D707 D708 D709 D710 D711 D712 D713 D715B D715G D715R D720 D722 D782 D801 D802 D803 | | |
| D404 {VMA(NT)/VMB(NT) /VMB(EE)(NT)} | | |
| D760B D760G D760R D761B D761G D761R D781B D781G D781R | 360K1032 | DIODE 1SS82-TA |
| ZD553 | 360K3134 | DIODE RD15EB(2)-T4 |
| ZD502 | 360K3143 | DIODE,RD8.2JSB(1)-T4 |
| ZD402 | 360K3602 | DIODE RD2.0ESB(1)-T4 |

| SYMBOL | PARTS NO | DESCRIPTION |
|---|---|---|
| ZD556 ZD560 ZD561 ZD562 | 360K3624 | DIODE RD3.9ESB(2)-T4 |
| ZD851 | 360K3634 | DIODE RD5.1ESB(1)-T4 |
| ZD563 | 360K3635 | DIODE RD5.1ESB(2)-T4 |
| ZD555 ZD557 ZD558 ZD559 | 360K3655 | DIODE RD8.2ESB(2)/ESAB(2) |
| ZD503 | 360K3659 | DIODE RD9.1ESB(2)-T4 |
| ZD505 ZD506 | 360K3709 | DIODE RD30ESB(1)/ESAB(1) |
| ZD504 | 360K3834 | DIODE MTZ11ABC T-72 |
| ZD570 | 36003662 | DIODE RD10ESB (1) |
| D560 | 361KH232 | DIODE RB721Q-T77 |
| D401 D509 D514 | 361K7160 | DIODE TVR-06G G23 |
| D519 D552 | | |
| D521 | 361K7550 | DIODE 1SR35-400A |
| D2004 D2005 D510 | 361K7562 | DIODE EGP10G G23 |
| D511 D512 D513 | | |
| D553 D557 D558 | | |
| D551 | 361K7630 | DIODE EU 2YX V1 |
| D501 | 36107293 | DIODE RK14 |
| D508 D518 | 36107507 | DIODE RG4 |
| ⚠D503 ⚠D504 | 36107560 | DIODE RG2A2 |
| D119 D120 | 36801331 | LED SLR-54MT3F/PQ |
| D118 | 36801342 | LED GL3EG8 |
| D721 | 38005054 | VARISTOR MA29W-A |

*** TRANSFORMERS ***

| | | |
|---|---|---|
| T501 | 45804007 | TRANS,H.DRIVE |
| L507 | 46206002 | TRANS,CHOKE 8MH |
| T551 | 46304108 | TRANS,CONVERTER |
| ⚠T503 | 47105673 | F.B.T |
| ⚠T502 | 47710014 | TRANS,H.OUT |

*** VARIABLE RESISTORS ***

| | | |
|---|---|---|
| VR704 VR705 VR706 | 410G1163 | R,VARIABLE B10K |
| VR701 VR702 VR703 | 410G1165 | R,VARIABLE B22K |
| VR707 VR708 VR709 | 410G1167 | R,VARIABLE B47K |
| VR710 | 410G1171 | R,VARIABLE B220K |
| VR101 VR102 | 41011121 | R,VARIABLE B50K |
| VR551 | 41071310 | R,VARIABLE B3.3K |
| VR401 | 41071357 | R,VARIABLE B1.0K |
| VR854 | 41071359 | R,VARIABLE B2.2K |
| VR402 | 41071363 | R,VARIABLE B10K |
| VR503 VR851 VR852 | 41085005 | R,VARIABLE B1K |
| VR501 | 41085008 | R,VARIABLE B5K |
| VR403 | 41085010 | R,VARIABLE B20K |
| VR502 | 41085018 | R,VARIABLE B100H |
| VR505 | 41505158 | R,VARIABLE B10K |
| VR552 | 41599203 | R,VARIABLE B200H |

*** RELAYS & SWITCHES ***

| | | |
|---|---|---|
| SW112 | 65161048 | SWITCH,SLIDE |
| SW111 | 65161059 | SWITCH,SLIDE 1-6L-3NS |
| SW101 SW102 SW103 SW104 SW105 SW106 SW107 SW108 SW109 SW110 | 653F0031 | SWITCH,PUSH BUTTON |

| SYMBOL | PARTS NO | DESCRIPTION |
|---|---|---|
| SW | 65360027 | SWTCH,PUSH BUTTON |
| ⚠RL501 | 65660013 | RELAY VE 24HME-K |

*** COILS & FILTERS ***

| | | |
|---|---|---|
| FR853 | 390C0409 | R,NETWORK 5*1.0K 5% 1/8W |
| FR851 FR852 | 390C0432 | R,NETWORK 6*10K 5% 1/8W |
| FR850 | 390C0437 | R,NETWORK 3*10K 5% 1/8W |
| LC802 LC803 LC804 LC805 | 390J9015 | FILTER ZJSC-2R2-101TA |
| LC701 LC702 LC703 | 390J9027 | FILTER ZJSC-R12-100TA |
| FC701 FC850 FC852 FC854 FC855 | 39013039 | C,CERAMIC 25V 0.1UF |
| FC851 FC853 | 39013041 | C,CERAMIC 25V 0.1UF |
| ⚠L501 VMA(N)/VMA(NT)/ VMB(N)/VMB(NT) VMR(N)/VMB(EE)(N) /VMB(EE)(NT) | 60919119 | COIL .H.LIN 19T |
| ⚠L501 VMA(H)/VMB(H)/ VMR(H)/VMB(EE)(H) | 60919120 | COIL .H.LIN 21T |
| ⚠L502 VMA(N)/VMA(NT)/ VMB(N)/VMR(N)/ VMB(EE)(NT)/ VMB(EE)(N)/VMB(NT) | 60919120 | COIL .H.LIN 21T |
| ⚠L502 VMA(H)/VMB(H)/ VMR(H)/VMB(EE)(H) | 60919118 | COIL .H.LIN 16T |
| L761 | 610E1711 | COIL,FILTER 3.3UH |
| L701B L701G L701R | 610E1726 | COIL,FILTER 56UHA,T (S) |
| L505 L509 L551 L552 | 610F3025 | COIL,FILTER 47UH |
| L801 | 610F7010 | COIL,FILTER 2.7UH |
| L901 L902 L903 | 610F8035 | COIL,FILTER PR27MAT |
| L553 | 61005008 | COIL,FILTER 120UH 37MHZ |
| FL001 | 61062076 | POWER LINE FILTER |
| L504 | 61070136 | FILTER CHOKE 4MH |
| ⚠L503 | 61070180 | COIL,CHOKE 2.5MH |
| ⚠L510 L512 | 61099019 | COIL,CHOKE 10MH |
| LC781 LC902 | 616K6027 | NOISE FILTER 2A222-TA |
| LC783 LC901 | 616K6028 | NOISE FILTER 1H223X-TA |
| LC850 | 616K6718 | NOISE FILTER |
| LC760 | 616K6945 | NOISE FILTER TH18103MA |
| LC782 | 616K6966 | NOISE FILTER 250V 2200PF |
| LC801 | 61606822 | NOISE FILTER 50V 47UH |

*** PWB ASSYS ***

| | | |
|---|---|---|
| | 84N44C01 | VIDEO PWB ASSY |
| | 84N44L01 | CONTROL PWB ASSY |
| VMA(N)/VMB(N)/VMR(N)/ VMB(EE)(N) | 84N54F01 | MAIN PWB ASSY |
| VMA(H)/VMB(H)/VMR(H)/ VMB(EE)(H) | 84N44F01 | MAIN PWB ASSY |
| VMA(NT)/VMB(NT)/VMB(EE) (NT) | 84N92F01 | MAIN PWB ASSY |

| SYMBOL | PARTS NO | DESCRIPTION |
|---|---|---|
| *** ELECTRICAL PARTS & MISCELLANEOUS PARTS *** | | |
| HS401 | 31709202 | SHEET,INSULATOR |
| HS515 | 31709505 | SHEET,INSULATOR |
| HS505 | 31709507 | SHEET,INSULATOR HEAT SINK |
| SG901 SG902 SG903 SG904 | 329J0047 | ARRESTER (300V),AT52 |
| | 79100021 | UNIT 1 (H.V OSC) |
| ⚠ | 79100031 | UNIT 2 (H.V PROTECTOR) |
| L506 | 49801010 | INDUCTOR DUMMY |
| X1 | 64099072 | CRYSTAL RESONATOR |
| SG905 | 66706002 | SPARK GAP 1.5KV |
| | 70032056 | CRT SOCKET |
| CABLE | 73893103 | CABLE SIGNAL |
| *** APPEARANCE PARTS *** | | |
| | 25313791 | CABINET BACK ASSY |
| | 25313821 | CABINET BOTTOM |
| | 25419001 | REVOLVING STAND ASSY |
| | 25419021 | REVOLVING SPINDLE |
| | 25419831 | LID,CONTROL ASSY |
| | 25534631 | COIL SPRING |
| | 25607291 | SLIDE SHEET |
| | 25757643 | LABEL(REV.) |
| *** KNOBS & PUSH BUTTONS *** | | |
| | 25454671 | PUSH BUTTON (SW) |
| | 25454681 | KNOB CONTROL |
| | 25454691 | KNOB,SLIDE |
| *** PRINTED & PACKING MATERIALS *** | | |
| | 24813191 | BAG,POLYETHYLENE(150*370) |
| | 25823181 | FILLER (T) CARTON |
| | 25823191 | FILLER (B) CARTON |
| (VMA) | 78034298 | MONITOR QUESTIONNAIRE |
| | 78034404 | MONITOR SALES OFFICE LIST |
| *** RESISTORS *** | | |
| R532 | 401C6629 | R,CARBON 15H 5% 1/4W |
| R761B R761G R761R | 401C6633 | R,CARBON 22H 5% 1/4W |
| R509 ⚠R513 R522 | 401C6657 | R,CARBON 220H 5% 1/4W |
| R564 | 401C6671 | R,CARBON 820H 5% 1/4W |
| R504 R544 R556 | 401C6673 | R,CARBON 1.0K 5% 1/4W |
| R531 | 401C6677 | R,CARBON 1.5K 5% 1/4W |
| R575 R909 | 401C6689 | R,CARBON 4.7K 5% 1/4W |

| SYNBOL | PARTS NO | DESCRIPTION |
|---|---|---|
| (VMA) | 24L13513 | CARD,DHHS-NEC |
| (VMA) | 24M02911 | BAG,POLYETHYLENE (DHHS) |
| CORD (VMA) | 70810757 | LINE CORD 3P L-1.8 |
| CORD (VMB) | 70800066 | LINE CORD E-3 #8011 |
| CORD (VMR) | 75513033 | LINE CORD |
| CORD (VMB(EE)) | 70800324 | LINE,POWER |
| SW-PS(VMA) | 31102029 | SW.REG UNIT (SMP-120BB) |
| SW-PS(VMB/VMR/VMB(EE)) | 31104020 | SW.REG UNIT (SMP-120BB-1) |
| DG (VMA) | 61315104 | COIL,DEGAUSSING |
| DG (VMB/VMR/VMB(EE)) | 61315203 | COIL,DEGAUSSING |
| (VMA) | 25774671 | NAME PLATE,INSTRUCTION |
| (VMB/VMB(EE)) | 25775331 | NAME PLATE,INSTRUCTION |
| (VMR) | 25775341 | NAME PLATE,INSTRUCTION |
| (VMA) | 25313771 | CABINET FRONT ASSY |
| (VMB/VMR/VMB/(EE)) | 25314091 | CABINET FRONT ASSY |
| (VMA) | 25823201 | CARTON BOX |
| (VMB/VMB(EE)) | 25825091 | CARTON BOX |
| (VMR) | 25823901 | CARTON BOX |
| (VMA) | 78125381 | INSTRUCTION BOOK |
| (VMB/VMR/VMB(EE)) | 78125391 | INSTRUCTION BOOK |

| SYMBOL | | | PARTS NO | DESCRIPTION |
|---|---|---|---|---|
| R523 | R545 | | 401C6697 | R,CARBON 10K 5% 1/4W |
| R518 | R519 | R555 | 401G6101 | R,CARBON 1.0H 5% 1/4W |
| ⚠R536 | ⚠R537 | R538 | 401G6109 | R,CARBON 2.2H 5% 1/4W |
| R411 | | | 401G6117 | R,CARBON 4.7H 5% 1/4W |
| R570 | R571 | | 401G6133 | R,CARBON 22H 5% 1/4W |
| R506 | | | 401G6137 | R,CARBON 33H 5% 1/4W |
| R521 | | | 401G6143 | R,CARBON 56H 5% 1/4W |
| R520 | | | 401G6167 | R,CARBON 560H 5% 1/4W |
| R416 | R904 | R905 | 401H5637 | R,CARBON 33H 5% 1/2W |
| R906 | | | | |
| R908 | | | 401H5649 | R,CARBON 100H 5% 1/2W |
| R541 | R561 | | 401H5665 | R,CARBON 470H 5% 1/2W |
| R560 | | | 401H5681 | R,CARBON 2.2K 5% 1/2W |
| ⚠R533 | | | 401H5687 | R,CARBON 3.9K 5% 1/2W |
| R539 | | | 401H5689 | R,CARBON 4.7K 5% 1/2W |
| R572 | | | 401H5693 | R,CARBON 6.8K 5% 1/2W |
| J13 | | | 401J9820 | RD16Z,0H,AT52 |
| R408 | | | 401K5619 | R,CARBON 5.6H 5% 1/6W |
| R580 | | | 401K5625 | R,CARBON 10H 5% 1/6W |
| R907 | | | 401K5633 | R,CARBON 22H 5% 1/6W |
| R514 | R515 | R516 | 401K5649 | R,CARBON 100H 5% 1/6W |
| R712B | R712G | R712R | | |
| R718 | | | | |
| R710B | R710G | R710R | 401K5653 | R,CARBON 150H 5% 1/6W |
| R731B | R731G | R731R | | |
| R776 | | | | |
| R751B | R751G | R751R | 401K5655 | R,CARBON 180H 5% 1/6W |
| R750B | R750G | R750R | 401K5657 | R,CARBON 220H 5% 1/6W |
| R760B | R760G | R760R | | |
| R105 | R704B | R704G | 401K5659 | R,CARBON 270H 5% 1/6W |
| R704R | | | | |
| R415 | | | 401K5661 | R,CARBON 330H 5% 1/6W |
| R774B | R774G | R774R | 401K5663 | R,CARBON 390H 5% 1/6W |
| R502 | R8A4 | R892 | 401K5665 | R,CARBON 470H 5% 1/6W |
| R501 | R705B | R705G | 401K5667 | R,CARBON 560H 5% 1/6W |
| R705R | R762 | R822 | | |
| R823 | | | | |
| R711B | R711G | R711R | 401K5669 | R,CARBON 680H 5% 1/6W |
| R726B | R726G | R726R | 401K5671 | R,CARBON 820H 5% 1/6W |
| R901 | R902 | R903 | 401K5671 | R,CARBON 820H 5% 1/6W |
| R413 | R414 | R505 | 401K5673 | R,CARBON 1.0K 5% 1/6W |
| R577 | R706B | R706G | | |
| R706R | R770 | R771 | | |
| R775B | R775G | R775R | | |
| R8A9 | R810 | R811 | | |
| R816 | R821 | R825 | | |
| R826 | R827 | R888 | | |
| R889 | R894 | R899 | | |
| R772 | R803 | R807 | 401K5679 | R,CARBON 1.8K 5% 1/6W |
| R417 | R563 | R8A6 | 401K5681 | R,CARBON 2.2K 5% 1/6W |
| R402 | R792 | R8A5 | 401K5685 | R,CARBON 3.3K 5% 1/6W |
| R720B | R720G | R720R | 401K5687 | R,CARBON 3.9K 5% 1/6W |
| R412 | R553 | R729 | 401K5689 | R,CARBON 4.7K 5% 1/6W |
| R730 | R790 | R8B0 | | |
| R8B1 | R8B2 | | | |
| R728 | R8A8 | R8B3 | 401K5691 | R,CARBON 5.6K 5% 1/6W |
| R8B4 | R8B5 | R8B6 | | |
| R814 | R859 | R860 | | |

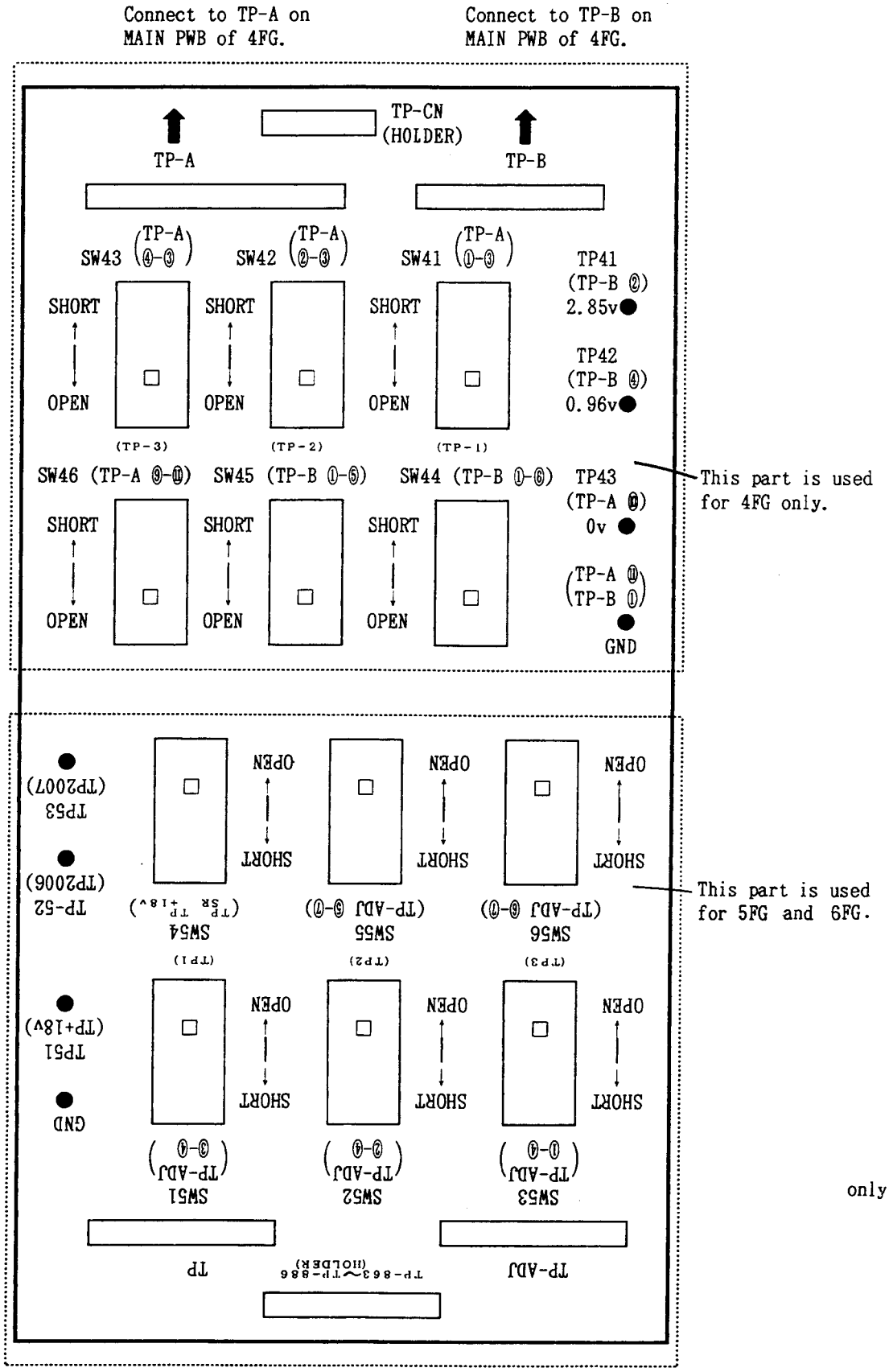
| SYMBOL | | | PARTS NO | DESCRIPTION |
|---|---|---|---|---|
| R861 | R865 | R866 | | |
| R867 | R868 | R869 | | |
| R870 | R871 | R872 | | |
| R873 | R874 | R875 | | |
| R702B | R702G | R702R | 401K5695 | R,CARBON 8.2K 5% 1/6W |
| R716 | | | | |
| R732B | R732G | R732R | 401K5696 | R,CARBON 9.1K 5% 1/6W |
| R106 | R529 | R559 | 401K5697 | R,CARBON 10K 5% 1/6W |
| R573 | R574 | R703B | | |
| R703G | R703R | R717 | | |
| R791 | R8A3 | R8B7 | | |
| R813 | R856 | | | |
| R727 | | | 401K5699 | R,CARBON 12K 5% 1/6W |
| R524 | | | 401K5701 | R,CARBON 15K 5% 1/6W |
| R404 | R405 | R784B | 401K5703 | R,CARBON 18K 5% 1/6W |
| R784G | R784R | | | |
| R576 | R713B | R713G | 401K5705 | R,CARBON 22K 5% 1/6W |
| R713R | R785B | R785G | | |
| R785R | R787 | | | |
| R802 | R806 | R809 | 401K5707 | R,CARBON 27K 5% 1/6W |
| R406 | R783B | R783G | 401K5709 | R,CARBON 33K 5% 1/6W |
| R783R | | | | |
| R801 | R805 | | 401K5711 | R,CARBON 39K 5% 1/6W |
| R857 | R887 | | 401K5713 | R,CARBON 47K 5% 1/6W |
| R817 | R819 | | 401K5717 | R,CARBON 68K 5% 1/6W |
| R409 | R525 | R8B8 | 401K5721 | R,CARBON 100K 5% 1/6W |
| R808 | R815 | | | |
| R782B | R782G | R782R | 401K5723 | R,CARBON 120K 5% 1/6W |
| R535 | R781B | R781G | 401K5729 | R,CARBON 220K 5% 1/6W |
| R781R | | | | |
| R534 | R780B | R780G | 401K5731 | R,CARBON 270K 5% 1/6W |
| R780R | | | | |
| R526 | R546 | R547 | 401K5733 | R,CARBON 330K 5% 1/6W |
| R786 | | | 401K5749 | R,CARBON 1.5M 5% 1/6W |
| R789 | | | 401K5753 | R,CARBON 2.2M 5% 1/6W |
| R8A7 | | | 40175139 | R,CARBON 39H 5% 1/4W |
| R101 | | | 40185171 | R,CARBON 820H 5% 1/2W |
| R510 | | | 40216266 | R,WIRE 2.4H 5% 7W |
| R554 | | | 403F1101 | R,METAL OXIDE 1H 5% 1W |
| R540 | | | 403F1107 | R,METAL 1.8H 5% 1W |
| R508B | | | 403F1137 | R,METAL 33H 5% 1W |
| R578 | | | 403F1177 | R,METAL OXIDE 1.5K 5% 1W |
| R508A | | | 403F2145 | R,METAL 68H 5% 2W |
| R410 | | | 403F2151 | R,METAL OXIDE 120H 5% 2W |
| R511 | | | 40372107 | R,METAL 1.8H 5% 2W |
| R548 | | | 40372133 | R,METAL 22H 5% 2W |
| R724 | | | 404C1662 | R,METAL 360H 1% 1/6W |
| R898 | | | 404C1673 | R,METAL 1.0K 1% 1/6W |
| R893 | R896 | | 404C1675 | R,METAL 1.2K 1% 1/6W |
| R890 | | | 404C1677 | R,METAL 1.5K 1% 1/6W |
| R528 | R895 | | 404C1680 | R,METAL 2.0K 1% 1/6W |
| R723 | | | 404C1684 | R,METAL 3.0K 1% 1/6W |
| R804 | | | 404C1688 | R,METAL 4.3K 1% 1/6W |
| R891 | | | 404C1695 | R,METAL 8.2K 1% 1/6W |
| R530 | R8A1 | | 404C1697 | R,METAL 10K 1% 1/6W |
| R527 | R897 | | 404C1698 | R,METAL 11K 1% 1/6W |
| R721 | | | 404C1700 | R,METAL 13K 1% 1/6W |

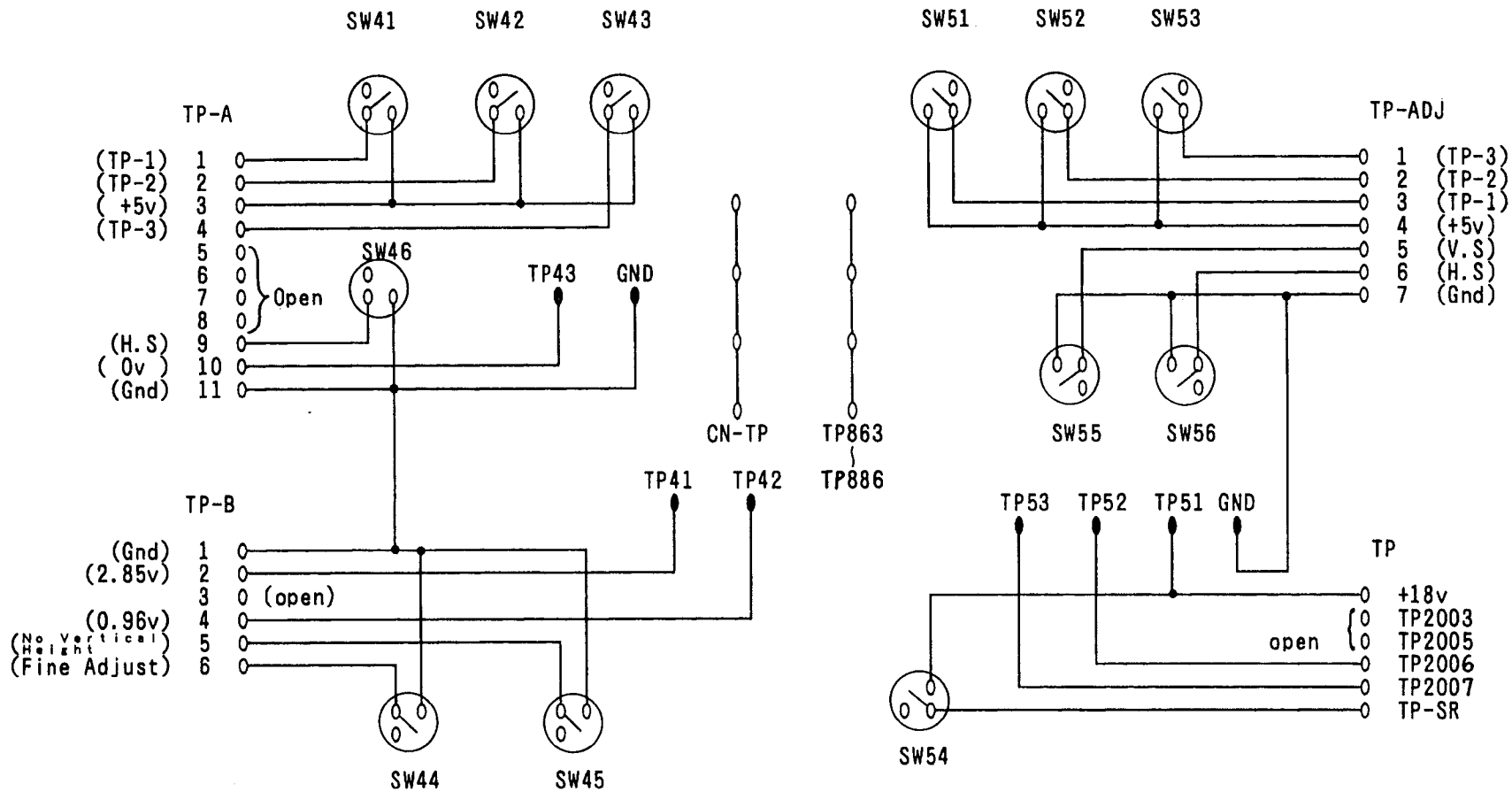
| SYMBOL | | | PARTS NO | DESCRIPTION |
|---|---|---|---|---|
| R722 | | | 404C1707 | R,METAL 27K 1% 1/6W |
| R8A0 | | | 404C1708 | R,METAL 30K 1% 1/6W |
| R562 | | | 404C1724 | R,METAL 130K 1% 1/6W |
| R549 | | | 404C1739 | R,METAL 560K 1% 1/6W |
| R701B | R701G | R701R | 404K2646 | R,METAL 75H 1% 1/4W |
| R507 | | | 40801004 | R,FUSE 1H 500MA |

*** CAPACITORS ***

| | | | | |
|---|---|---|---|---|
| C901 | | | 420C9551 | C,CERAMIC 500V 100PF |
| ⚠C512 | C783B | C783G | 420C9563 | C,CERAMIC 500V 1000PF |
| C783R | C902 | | | |
| C787 | | | 420C9565 | C,CERAMIC 500V 1500PF |
| C504 | | | 420C9567 | C,CERAMIC 500V 2200PF |
| C903 | | | 420DK108 | C,CERAMIC 2KV 10000PF |
| C563 | C703B | C703G | 421A0425 | C,CERAMIC 50V 0.01UF |
| C703R | | | | |
| C721B | C721G | C721R | 421C0213 | C,CERAMIC 50V 1000PF |
| C552 | C725B | C725G | 421C0225 | C,CERAMIC 50V 0.01UF |
| C725R | C726B | C726G | | |
| C726R | C727 | C731 | | |
| C732 | C750B | C750G | | |
| C750R | C751 | | | |
| C513 | C514 | C515 | 421C2862 | C,CERAMIC 25V 0.01UF |
| C101 | C542 | C548 | 421C3479 | C,CERAMIC 50V 0.1UF |
| C565 | C8A4 | C8A5 | | |
| C8A6 | C874B | C880 | | |
| C887 | C888 | C889 | | |
| C890 | C891 | C892 | | |
| C893 | C894 | C895 | | |
| C546 | C701 | C709B | 421D6009 | C,CERAMIC 25V 0.1UF |
| C709G | C709R | C710 | | |
| C713 | C760 | C8A2 | | |
| C8A3 | C804 | C806 | | |
| C794B | C794G | | 42130721 | C,CERAMIC 50V 4700PF 10% |
| C405 | | | 423A1025 | C,CERAMIC 50V 15PF |
| C545 | | | 423A1045 | C,CERAMIC 50V 100PF |
| C856 | C857 | | 423A2015 | C,CERAMIC 50V 10PF |
| C820 | | | 423A2025 | C,CERAMIC 50V 15PF |
| C819 | | | 423A2033 | C,CERAMIC 50V 33PF |
| C764B | C764G | C764R | 423A2043 | C,CERAMIC 50V 82PF |
| C805 | | | 423A2101 | C,CERAMIC 50V 120PF |
| C789 | | | 427E4163 | C,FILM 100V 0.01UF |
| C411 | | | 427F4066 | C,FILM 50V 0.018UF |
| C529 | | | 427F4075 | C,FILM 50V 0.1UF |
| C808 | C809 | | 427F4601 | C,FILM 50V 1000PF |
| C810 | | | 427F4609 | C,FILM 50V 4700PF |
| C406 | | | 427F4667 | C,FILM 50V 0.022UF |
| C528 | | | 427F8225 | C,FILM 50V 1000PF |
| C402 | | | 428B3025 | C,METAL FILM 50V 1.0UF |
| C526 | | | 428B3121 | C,METAL FILM 50V 0.47UF |
| C520 | C532 | C537 | 428CJ022 | C,METAL FILM 250V 0.1UF |
| C790 | | | 428DD417 | C,METAL FILM 250V 0.22UF |
| ⚠C530 | C531 | | 42807516 | C,FILM 1.6KV 4300PF |
| ⚠C506 | | | 42817003 | C,METAL FILM 1.4KV 3300PF |
| ⚠C509 | | | 42839307 | C,FILM 400V 0.27UF |
| ⚠C507 | | | 42839710 | C,METAL 400V 0.39UF |

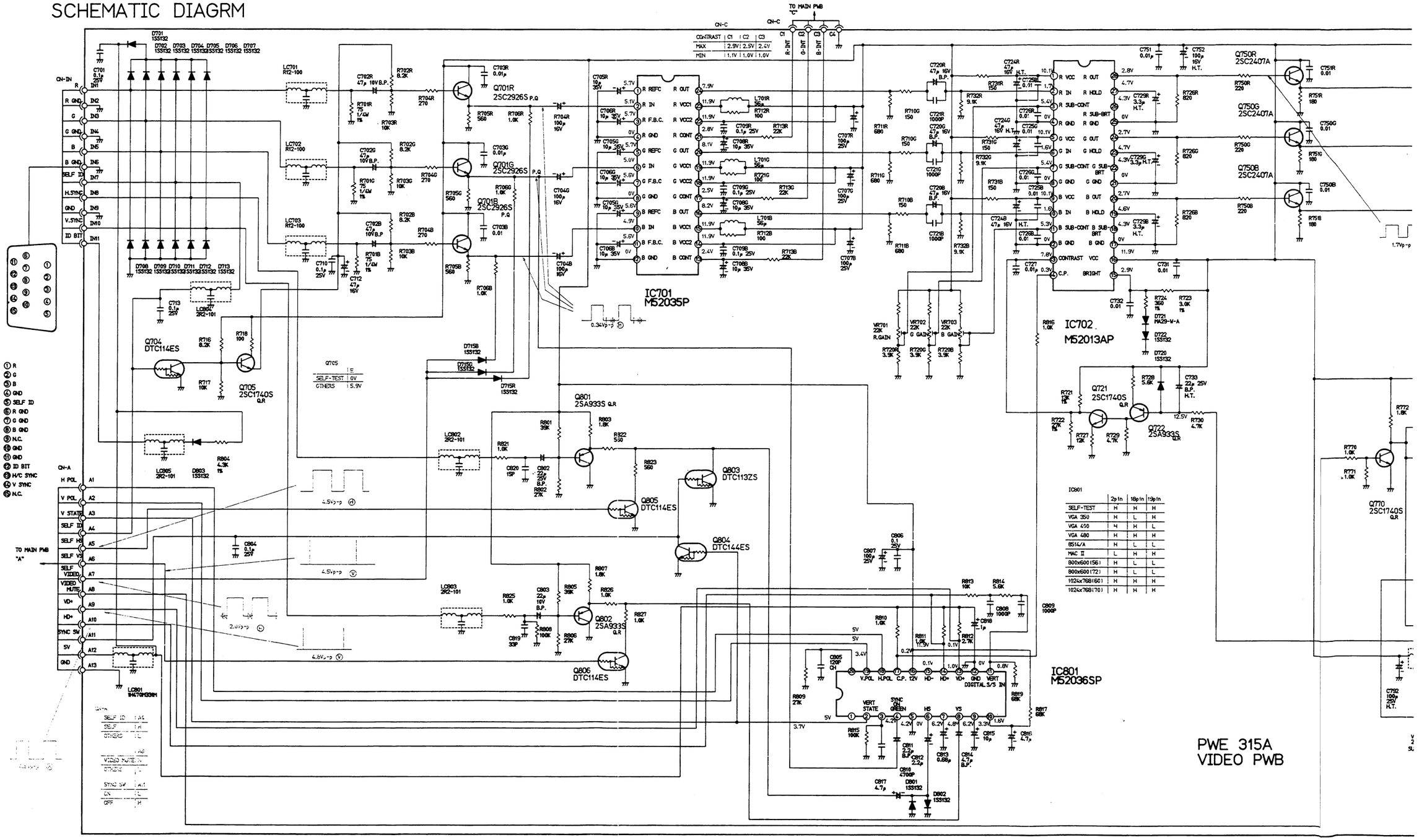
| SYMBOL | | | PARTS NO | DESCRIPTION |
|---|---|---|---|---|
| C781B | C781G | C781R | 42840097 | C,FILM 250V 0.22UF |
| ⚠C508 | | | 42843509 | C,METAL 400V 0.12UF |
| C813 | | | 430A4104 | C,ELEC 50V 0.68UF |
| C516 | C517 | | 430B6017 | C,ELEC 10V 220UF |
| C8A1 | | | 430B6029 | C,ELEC 16V 100UF |
| C547 | | | 430B6031 | C,ELEC 16V 330UF |
| C412 | C899 | | 430B6041 | C,ELEC 25V 47UF |
| C707B | C707G | C707R | 430B6042 | C,ELEC 25V 100UF |
| C807 | | | | |
| C818 | | | 430B6061 | C,ELEC 50V 1.0UF |
| C812 | | | 430B6062 | C,ELEC 50V 2.2UF |
| C816 | C817 | | 430B6064 | C,ELEC 50V 4.7UF |
| ⚠C2001 | ⚠C2002 | C815 | 430B6065 | C,ELEC 50V 10UF |
| C855 | | | | |
| C523 | | | 430B6512 | C,ELEC 160V 1.0UF |
| C874A | C891B | | 430B8134 | C,ELEC 10V 100UFF |
| C8A7 | | | 430B8141 | C,ELEC 16V 10UF |
| C704B | C704G | C704R | 430B8145 | C,ELEC 16V 100UF |
| C501 | C560 | | 430B9015 | C,ELEC 10V 47UF |
| C8A0 | | | 430B9016 | C,ELEC 10V 100UF |
| C580 | | | 430B9017 | C,ELEC 10V 220UF |
| C558 | | | 430B9019 | C,ELEC 10V 470UF |
| C557 | | | 430B9020 | C,ELEC 10V 1000UF |
| C712 | C724B | C724G | 430B9028 | C,ELEC 16V 47UF |
| C724R | | | 430B9028 | C,ELEC 16V 47UF |
| C752 | | | 430B9029 | C,ELEC 16V 100UF |
| C401 | C562 | | 430B9030 | C,ELEC 16V 220UF |
| C793 | | | 430B9032 | C,ELEC 16V 470UF |
| C551 | | | 430B9033 | C,ELEC 16V 1000UF |
| C502 | C519 | C559 | 430B9041 | C,ELEC 25V 47UF |
| C898 | | | | |
| C554 | C761 | C792 | 430B9042 | C,ELEC 25V 100UF |
| C561 | | | 430B9045 | C,ELEC 25V 470UF |
| C553 | | | 430B9053 | C,ELEC 35V 47UF |
| C403 | C410 | C555 | 430B9054 | C,ELEC 35V 100UF |
| C404 | | | 430B9055 | C,ELEC 35V 220UF |
| C556 | | | 430B9057 | C,ELEC 35V 470UF |
| C729B | C729G | C729R | 430B9063 | C,ELEC 50V 3.3UF |
| C897 | | | 430B9068 | C,ELEC 50V 47UF |
| C527 | | | 430B9094 | C,ELEC 100V 1.0UF |
| C533 | C534 | | 430B9098 | C,ELEC 100V 10 UF |
| C782B | C782G | C782R | 430B9512 | C,ELEC 160V 1.0UF |
| C762 | | | 430B9516 | C,ELEC 160V 10UF |
| C540 | | | 430B9532 | C,ELEC 200V 1 UF |
| C541 | | | 430B9537 | C,ELEC 200V 22 UF |
| C786 | | | 430B9556 | C,ELEC 250V 10UF |
| C705B | C705G | C705R | 430C0065 | C,ELEC 35V 10UF |
| C706B | C706G | C706R | | |
| C708B | C708G | C708R | | |
| C503 | | | 430C6344 | C,ELEC 35V 100UF |
| C564 | | | 430C8525 | C,ELEC 25V 1000UF |
| C521 | | | 430J8102 | C,ELEC 160V 3.3UF |
| C522 | | | 430J8103 | C,ELEC 160V 10UF |
| C535 | | | 430J8104 | C,ELEC 200V 10UF |
| C539 | | | 4309H060 | C,ELEC 250V 3.3UF |
| C407 | | | 4309H061 | C,ELEC 35V 2200UF |

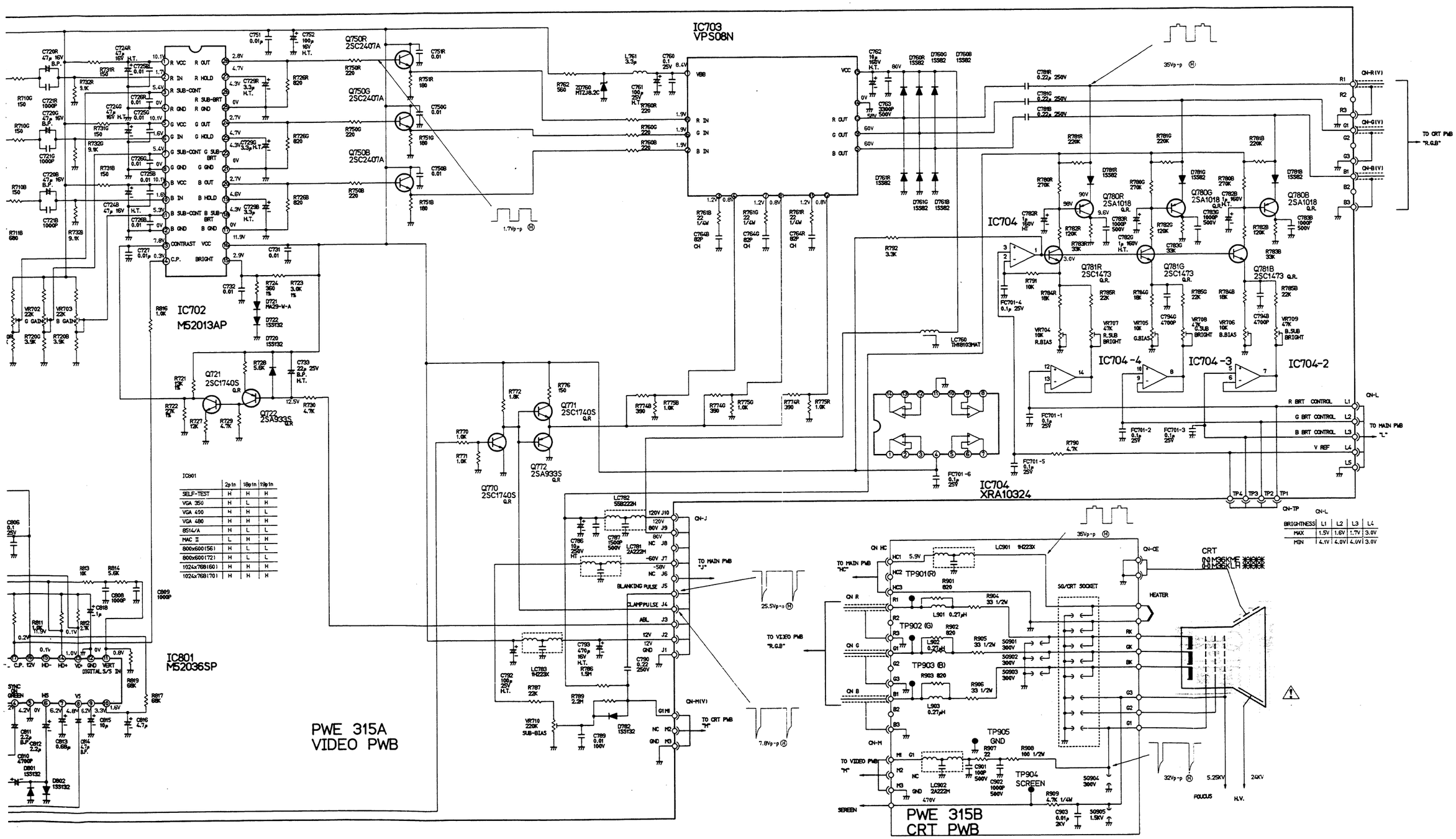

Connect to TP-A on MAIN PWB of 4FG.
Connect to TP-B on MAIN PWB of 4FG.
TP-CN (HOLDER)
TP-A
TP-B
SW43 (TP-A ④-③)
SW42 (TP-A ②-③)
SW41 (TP-A ①-③)
SHORT
OPEN
(TP-3)
(TP-2)
(TP-1)
TP41 (TP-B ②) 2.85v
TP42 (TP-B ④) 0.96v
SW46 (TP-A ⑨-⑩)
SW45 (TP-B ①-⑤)
SW44 (TP-B ①-⑥)
TP43 (TP-A ⑩)
0v
(TP-A ⑩ TP-B ①)
GND
This part is used for 4FG only.
TP53 (TP2007)
TP-52 (TP2006)
SW54 (TP+18v TPSR)
SW55 (TP-ADJ ⑨-⑩)
SW56 (TP-ADJ ⑨-⑩)
(TP1)
(TP2)
(TP3)
TP51 (TP+18v)
GND
SW51 (TP-ADJ ③-④)
SW52 (TP-ADJ ②-④)
SW53 (TP-ADJ ①-④)
TP
TP-863～TP-886 (HOLDER)
TP-ADJ
This part is used for 5FG and 6FG only




Adjustment jig Schematic Diagram

# MODEL JC-1531VMA/B/R/B(EE) VIDEO CRT PWB
## SCHEMATIC DIAGRM



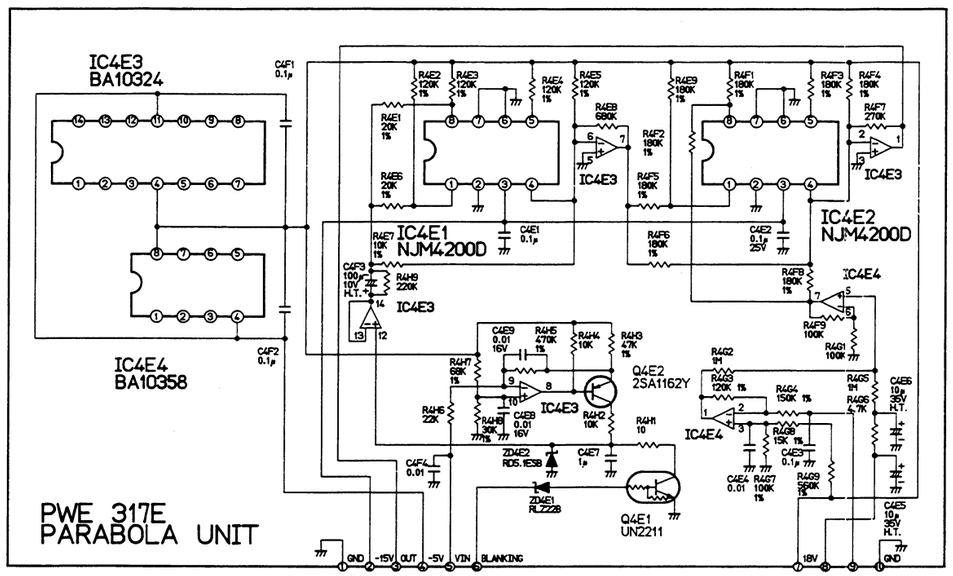


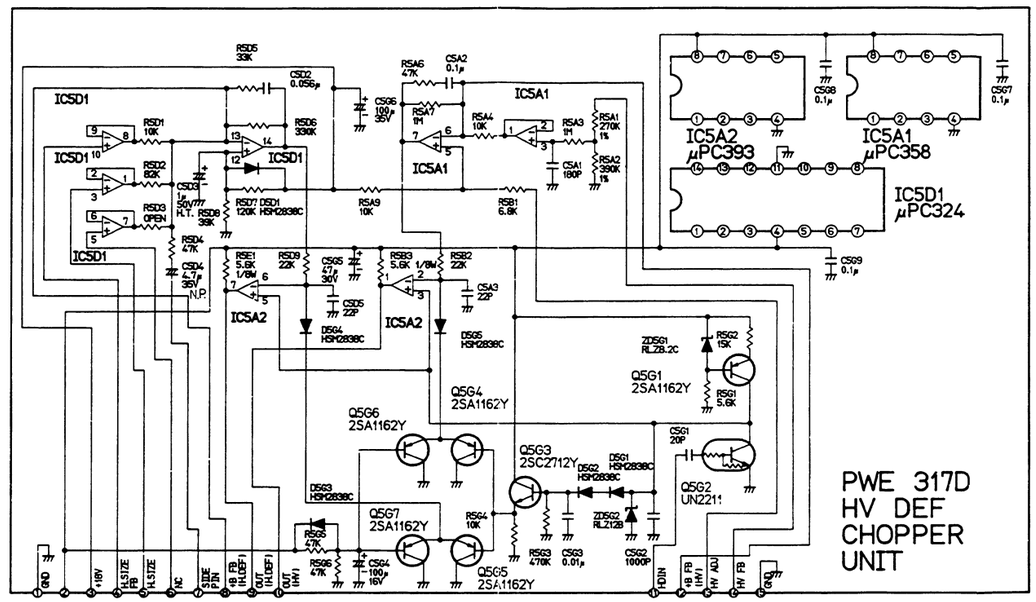

IC901

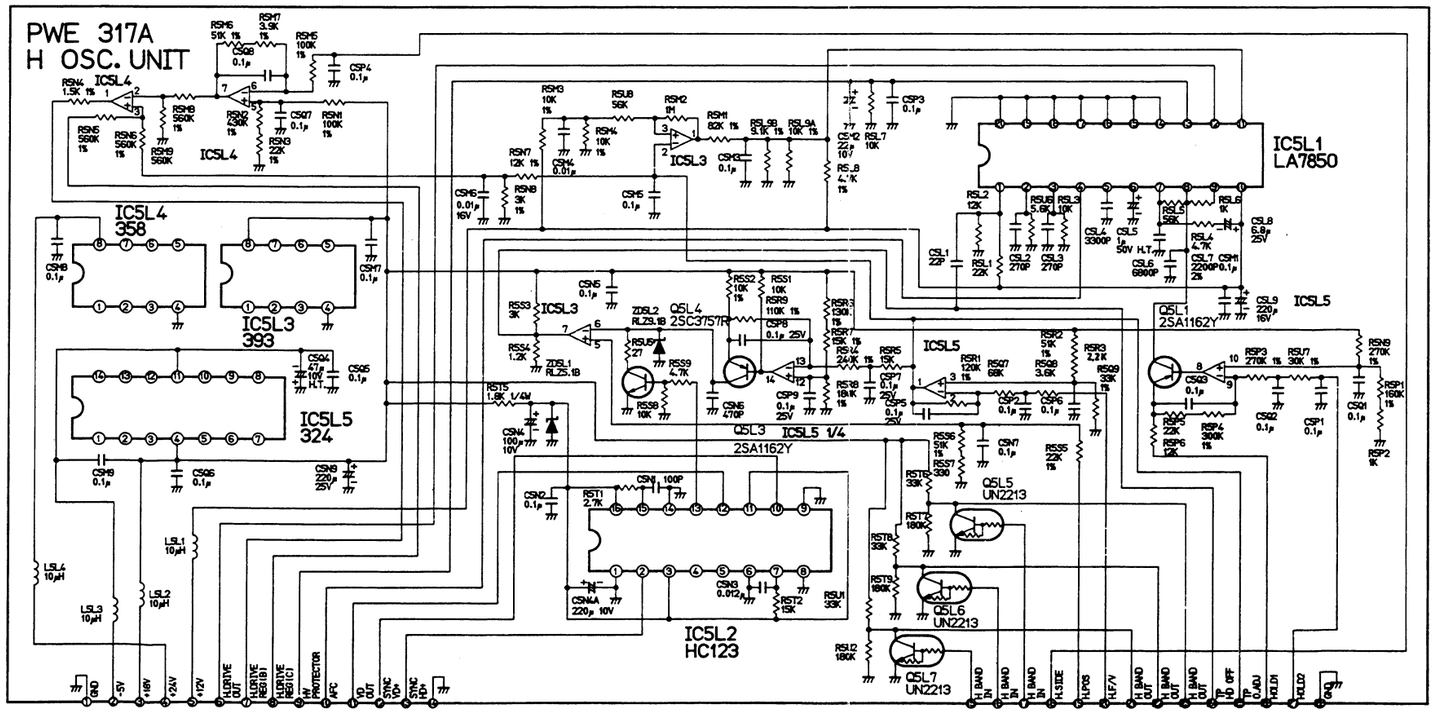
| | 2pin | 18pin | 19pin |
|---|---|---|---|
| SELF-TEST | H | H | H |
| VGA 350 | H | L | H |
| VGA 400 | H | H | L |
| VGA 480 | H | H | H |
| 8514/A | H | L | L |
| MAC II | L | H | H |
| 800x600(56) | H | L | L |
| 800x600(72) | H | L | L |
| 1024x768(60) | H | H | H |
| 1024x768(70) | H | H | H |

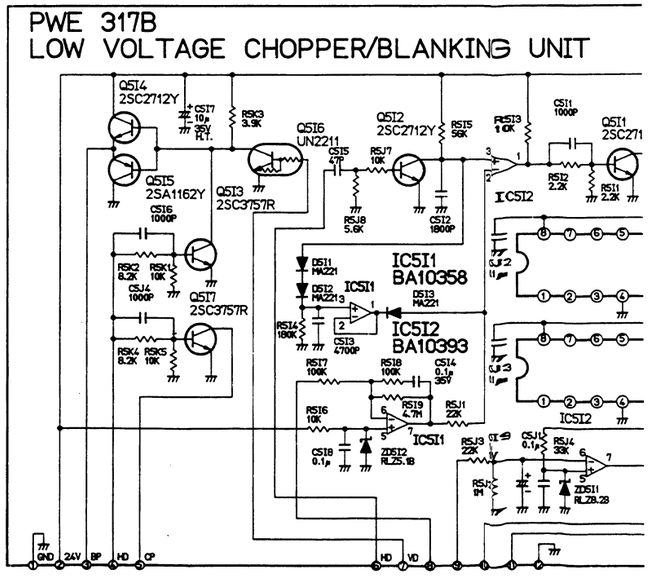
| BRIGHTNESS | L1 | L2 | L3 | L4 |
|---|---|---|---|---|
| MAX | 1.5V | 1.6V | 1.7V | 3.0V |
| MIN | 4.1V | 4.0V | 4.0V | 3.0V |

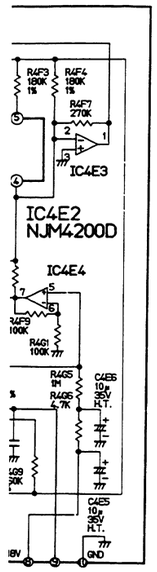
# MODEL JC-1531VMA/B/R/B(EE)
# UNIT PWB
# SCHEMATIC DIAGRAM

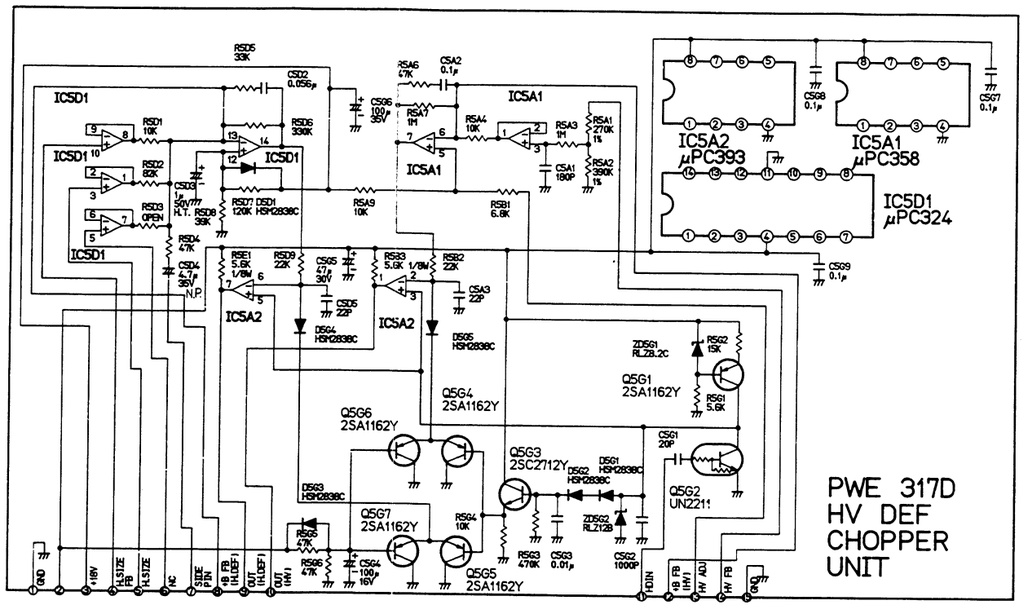


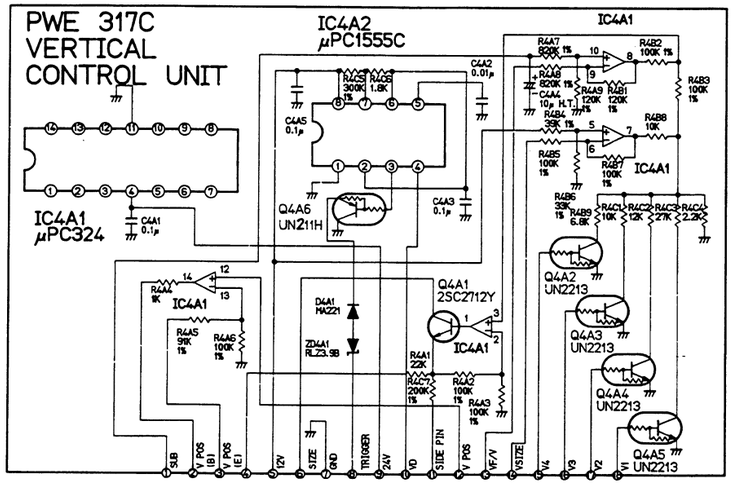



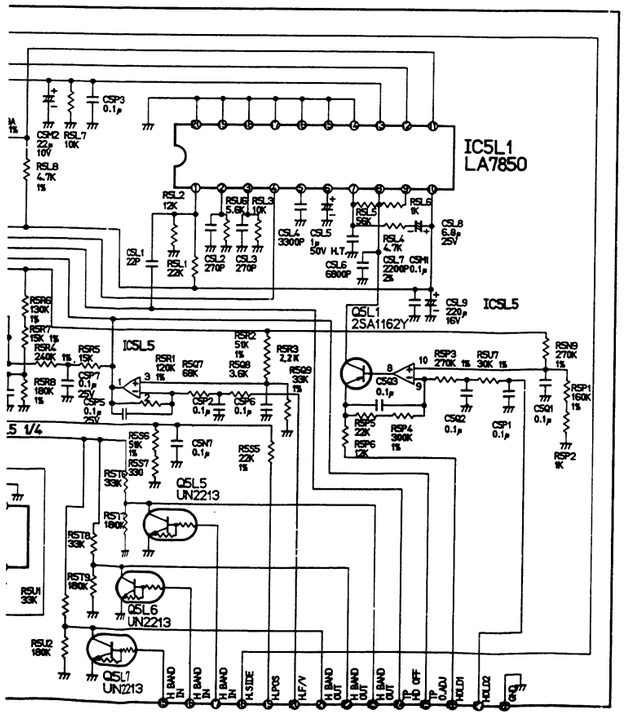



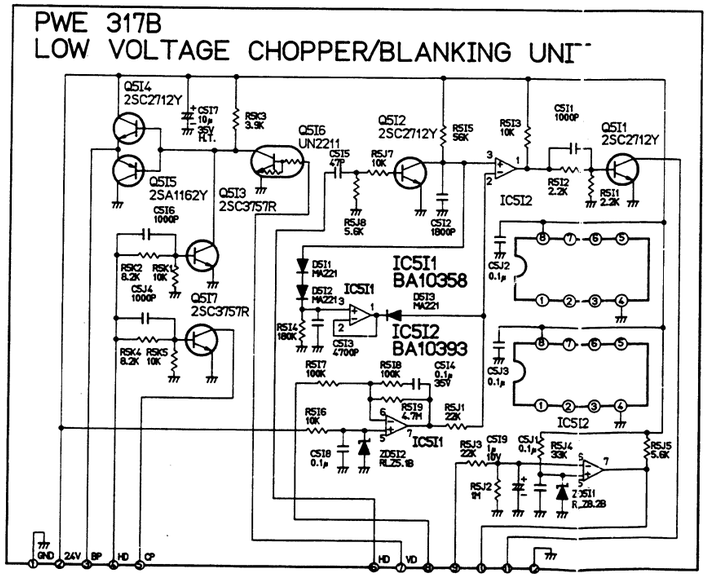



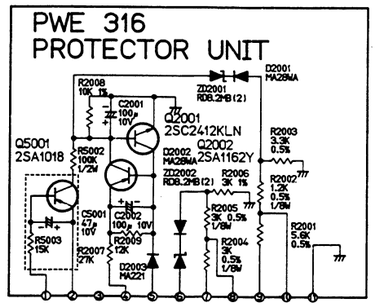

IC4E2
NJM4200D
IC4E3
IC4E4
GND


IC5D1
IC5A1
IC5A2
μPC393
μPC358
μPC324
ICSA1
ICSA2
Q5G1
2SA1162Y
Q5G2
UN2211
Q5G3
2SC2712Y
Q5G4
2SA1162Y
Q5G5
2SA1162Y
Q5G6
2SA1162Y
Q5G7
2SA1162Y
PWE 317D
HV DEF
CHOPPER
UNIT

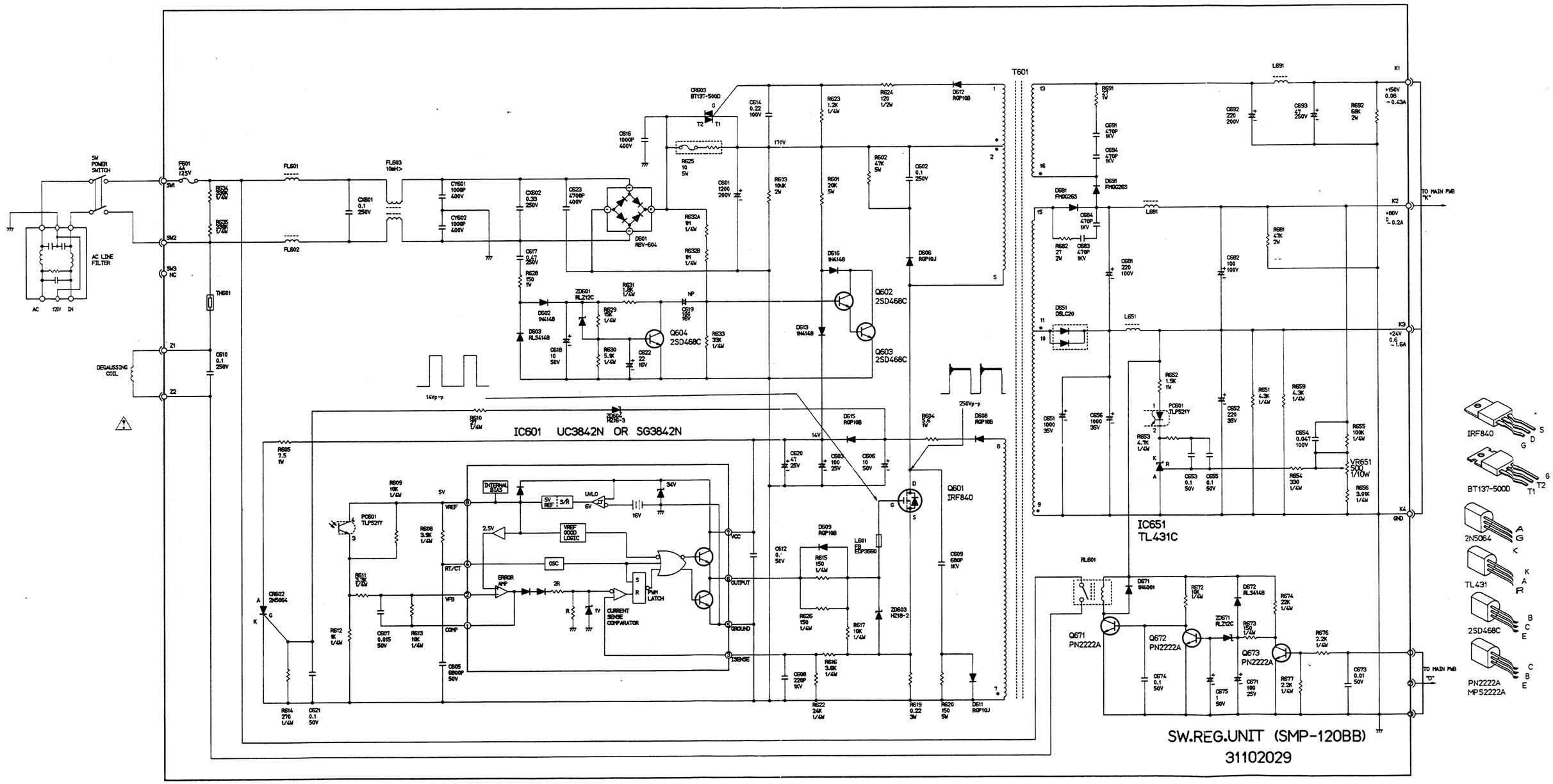

PWE 317C
VERTICAL
CONTROL UNIT
IC4A2
μPC1555C
IC4A1
μPC324
Q4A1
2SC2712Y
Q4A2
UN2213
Q4A3
UN2213
Q4A4
UN2213
Q4A5
UN2213
Q4A6
UN211H


IC5L1
LA7850
IC5L5
Q5L1
2SA1162Y
Q5L5
UN2213
Q5L6
UN2213
Q5L7
UN2213


PWE 317B
LOW VOLTAGE CHOPPER/BLANKING UNIT
IC5I1
BA10358
IC5I2
BA10393
Q5I1
2SC2712Y
Q5I2
2SC2712Y
Q5I3
2SC3757R
Q5I4
2SC2712Y
Q5I5
2SA1162Y
Q5I6
UN2211
Q5I7
2SC3757R

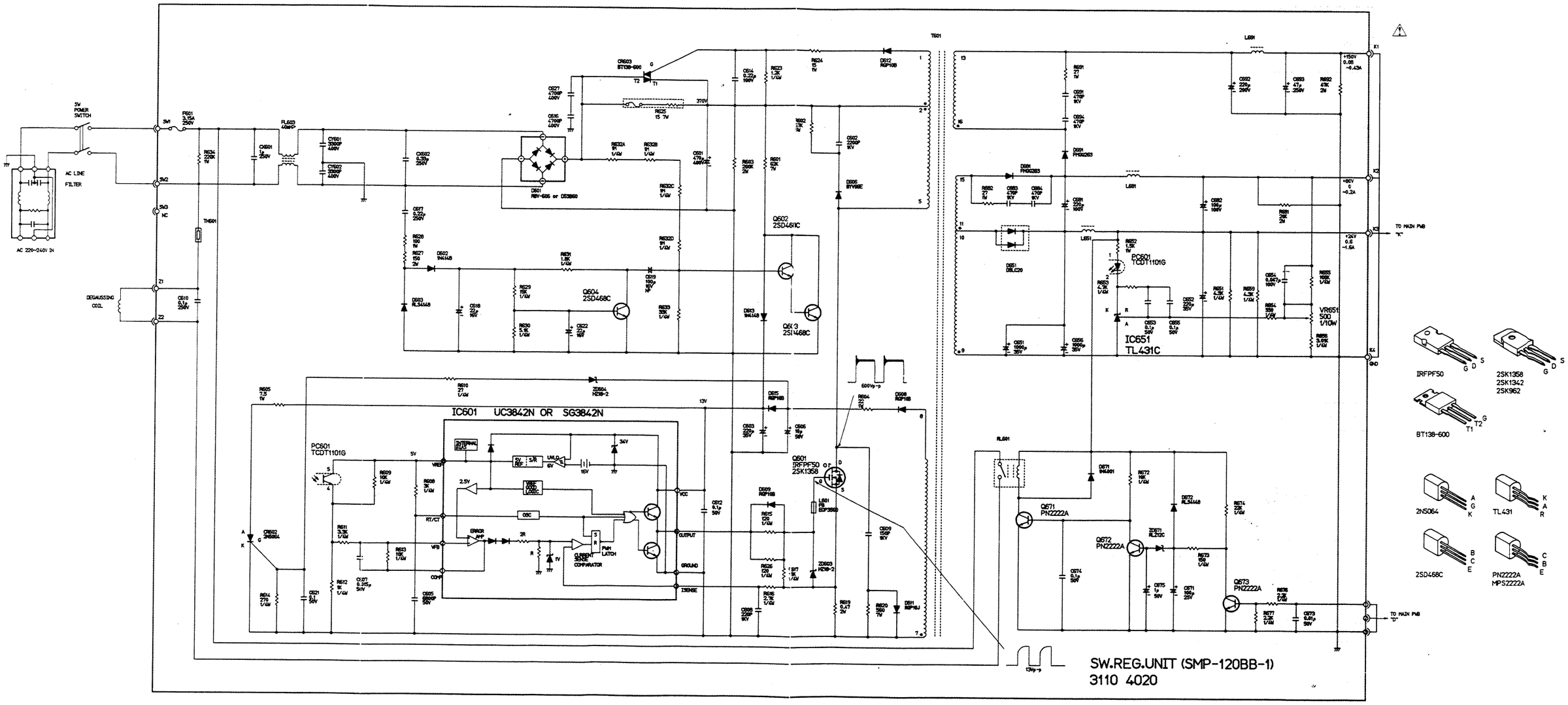

PWE 316
PROTECTOR UNIT
Q5001
2SA1018
Q2001
2SC2412KLN
Q2002
2SA1162Y

MODEL JC-1531VMA (SW. REG. PWB)
SCHEMATIC DIAGRAM



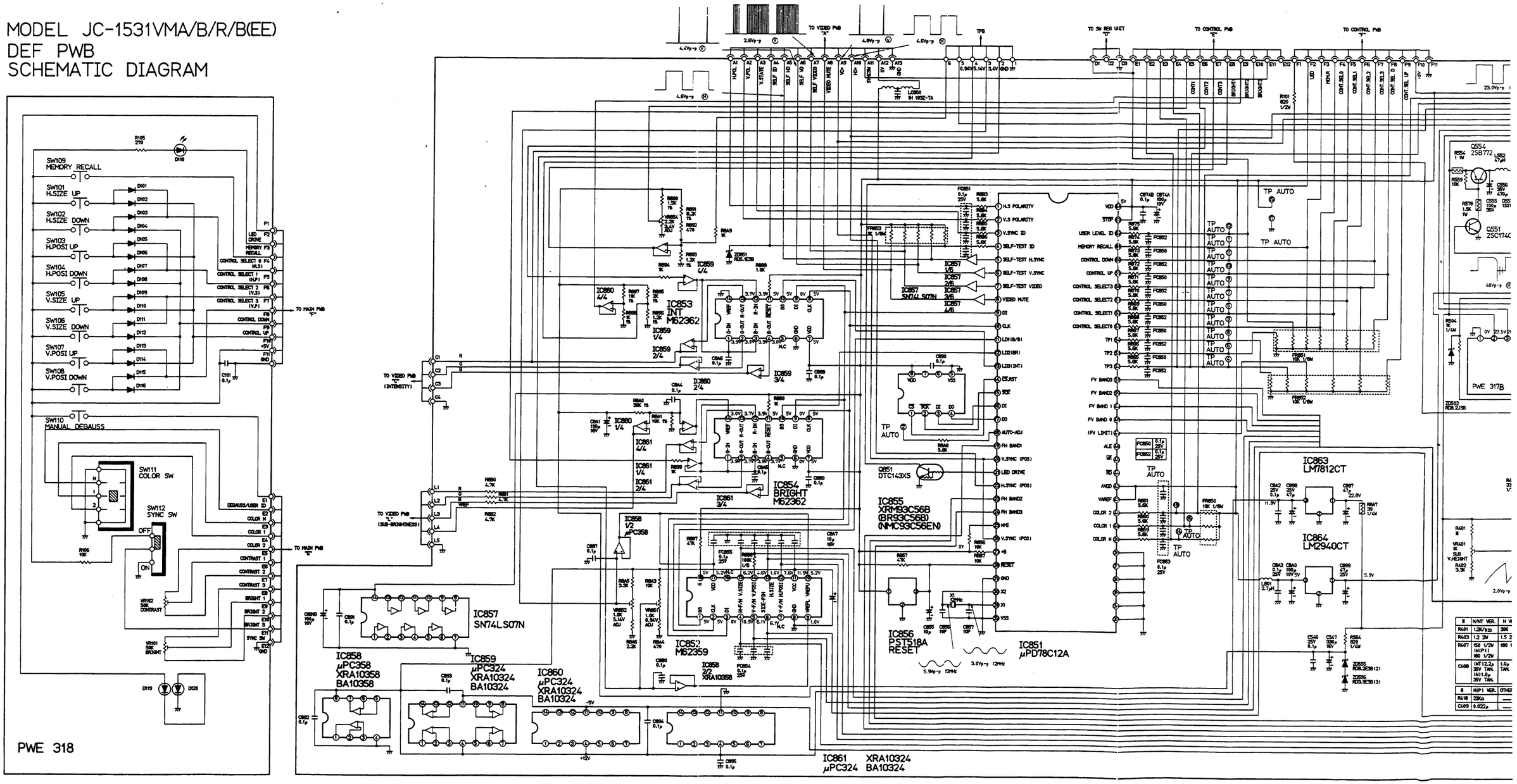
RUN NO.1

MODEL JC-1531VMB/R/B(EE)(SW. REG. PWB)
SCHEMATIC DIAGRM




78164291

# MODEL JC-1531VMA/B/R/B(EE)
# DEF PWB
# SCHEMATIC DIAGRAM



TP8

TO SW REG UNIT "D"

TO CONTROL PWB "E"

TO CONTROL PWB "F"

TPA

TO CRT PWB "K"

TO SW UNIT

TO VIDEO PWB "J"

V.DY

PWE 317A H OSC. UNIT

PWE 317B LOW VOLTAGE CHOPPER UNIT

PWE 317C V.CONTROL UNIT

PWE 317D HV DEF CHOPPER UNIT

PWE 317E PARABOLA UNIT

IC855 XRM93C56B (BR93C56B) (NMC93C56EN)

IC856 PST518A RESET

IC851 μPD78C12A

IC857 SN74LS07N

IC863 LM7812CT

IC864 LM2940CT

IC401 LA7837

IC552 LM2940CT-12

IC551 24MBHF

IC553 LM7812C

Q554 2SB772

Q551 2SC1740S

Q512 2SD2005R

Q511 2SB1329R

Q401 2SC3377

Q402 2SA1515

Q403 DTC114ES

Q522 2SC3811

Q518 2SC1740S

Q519 2SA933S

Q520 2SC1740S

Q521 2SA933S

Q851 DTC143XS

TS51

| | NAVI VER. | H VER. |
|---|---|---|
| R401 | 1.2K/1/2W | 390 |
| R403 | 1.2 2W | 1.5 2W |
| R407 | 150 1/2W IN(P1) 180 1/2W | 180 1/2W |
| C408 | IMT12.2μ 35V TAN. IM11.0μ 35V TAN. | 1.0μ 35V TAN. |

| | MIP1 VER. | OTHERS |
|---|---|---|
| R418 | 22KΩ | — |
| C409 | 0.022μ | — |

XRA10324
BA10324

TO CRT PWB "H"

TO SW UNIT

V.DY

TO VIDEO PWB "J"

CN-RH

PWE 317A H OSC. UNIT

PWE 317D HV DEF CHOPPER UNIT

PWE 317E PARABOLA UNIT

PWE 316 PROTECTOR UNIT

IC501
TC4538B
XRU4538B
μPD4538B

IC551
24MI6HF

IC553
LM7812C

T501

T502

T503

Q501 2SC1740S

Q502 2SA933

Q503 2SK699

Q504 2SB536

Q505 HPA100R4

Q506 2SK947 2SK758

Q507 2SK947 2SK758

Q508 2SK947

Q509 DTC143XS

Q510 IRF9610

Q511 2SB1329R

Q512 2SD2005R

Q513 2SC2001

Q514 2SA952

Q515 IRFPF40

Q517 IRF9610

Q518 2SC1740S

Q519 2SA933S

Q520 2SC1740S

Q521 2SA933S

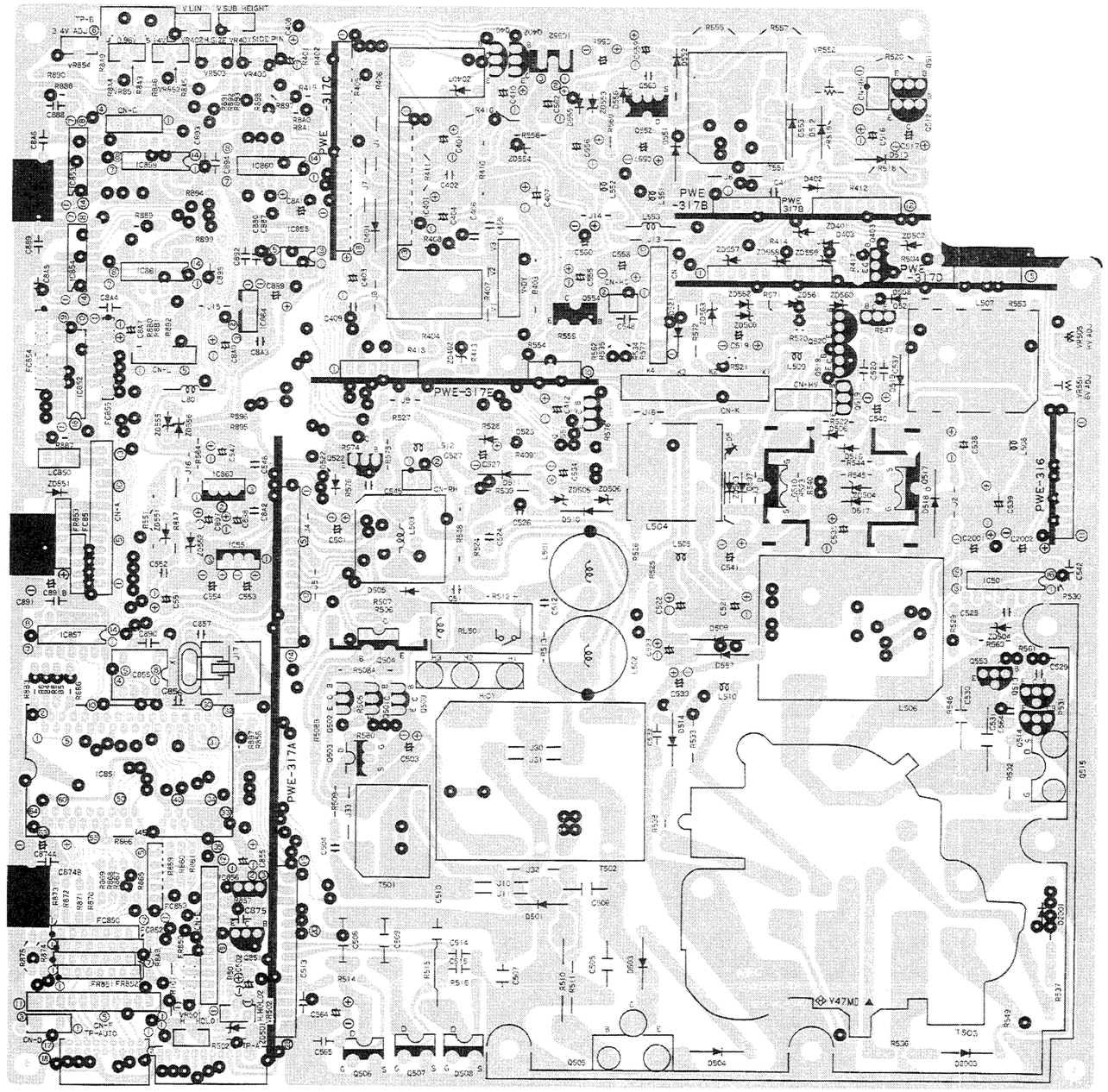
Q522 2SC3811

Q553 2SA933

Q403 DTC114ES

T551

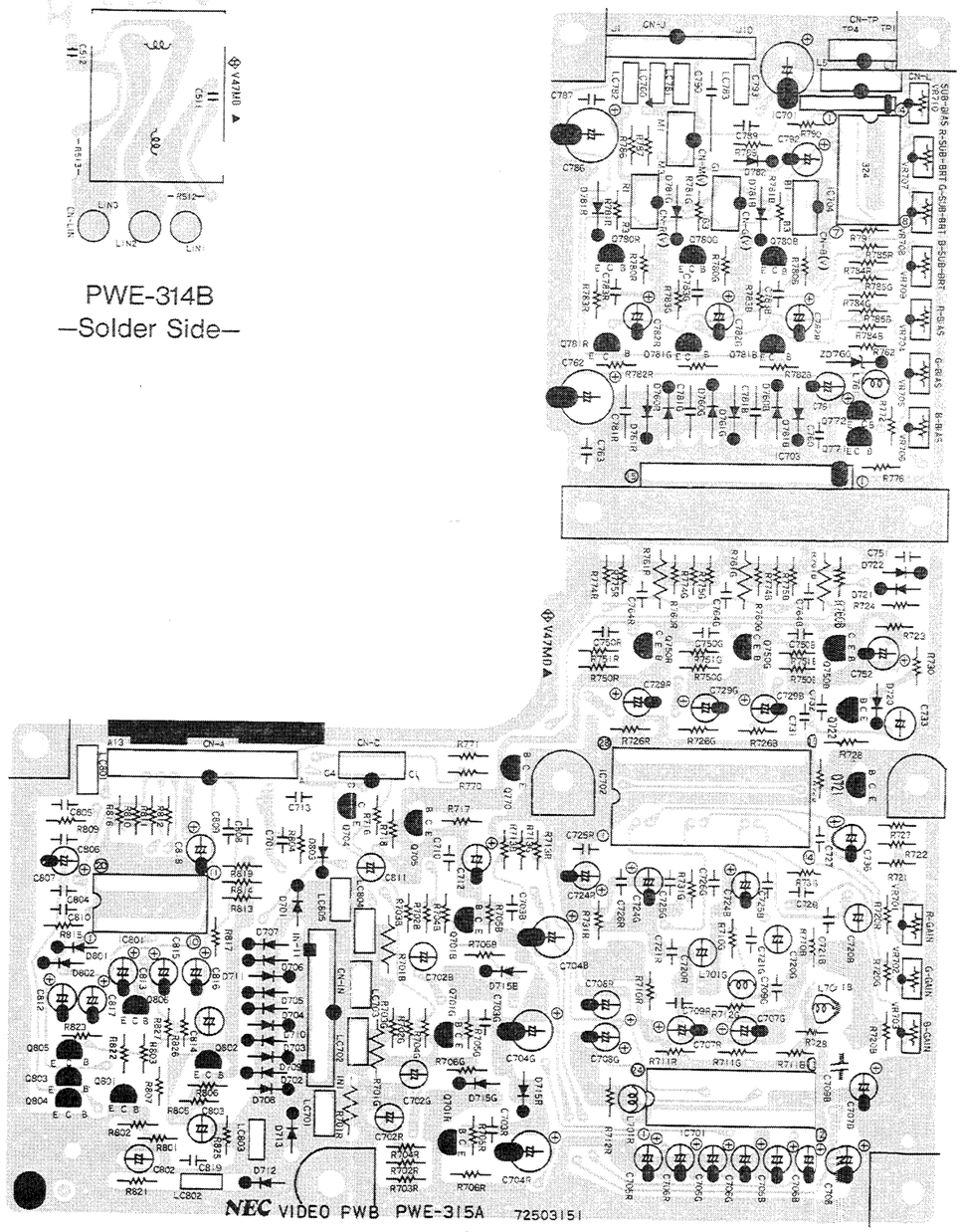
| | N/NT VER. | H VER. |
|---|---|---|
| C511 | 3300P 500V | 1500P 500V |
| R512 | 120 1/4W | 150 1/4W |
| C510 | 0.75 400V | 0.68 400V |
| L501 | 19T N515 | 21T N516 |
| L502 | 21T N516 | 16T N514 |



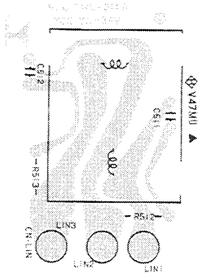

DEF PWB ASSY (PWE-314A)
—Solder Side—



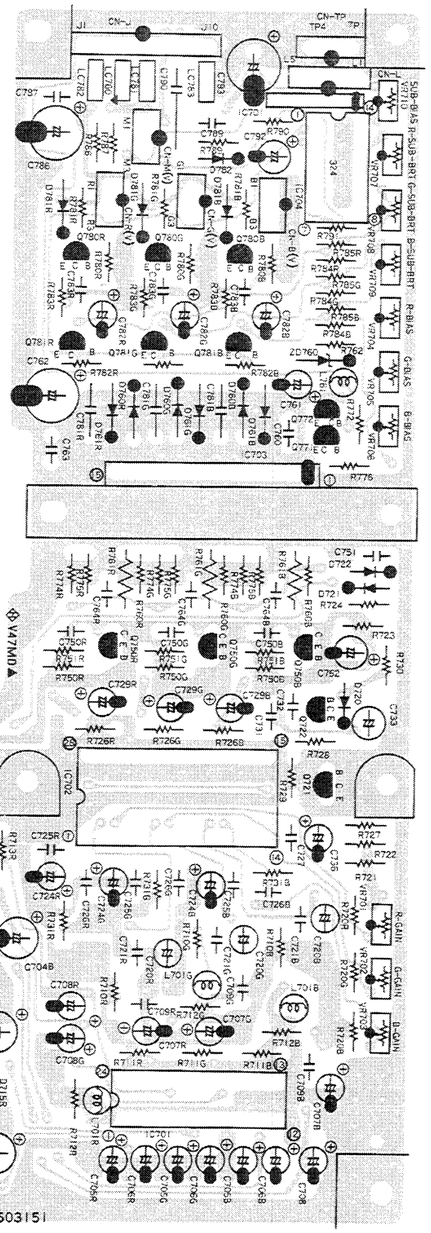

PWE-314B
—Solder Side—

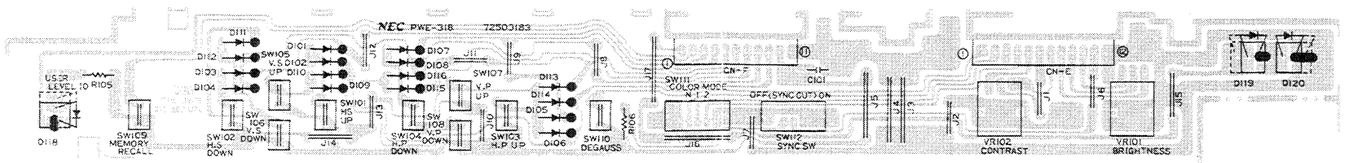



VIDEO PWB ASSY (PWE-315A)
—Component Side—

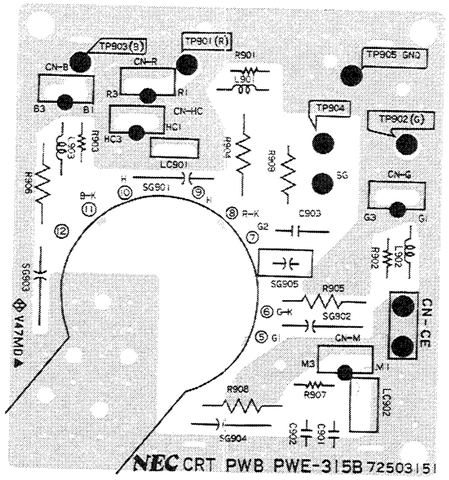


PWE-314B
—Solder Side—

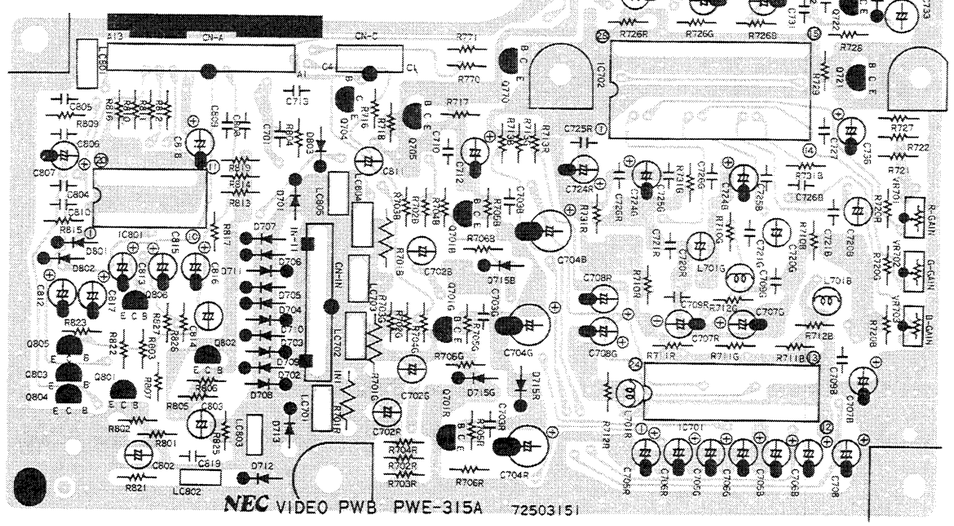




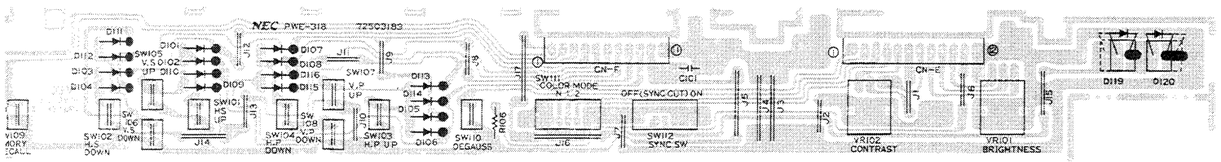

CONTROL PWB ASSY (PWE-318)
—Component Side—



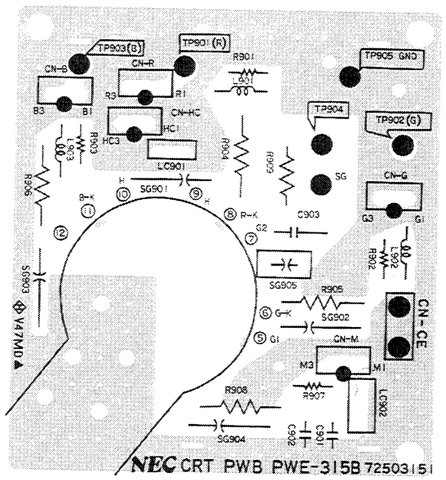

CRT PWB ASSY (PWE-315B)
—Component Side—




VIDEO PWB ASSY (PWE-315A)
—Component Side—

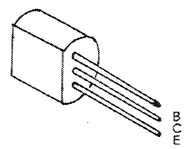



CONTROL PWB ASSY (PWE-318)
—Component Side—

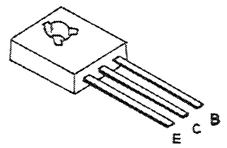



CRT PWB ASSY(PWE-315B)
—Component Side—

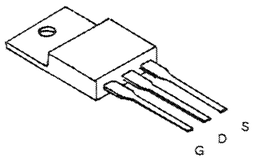
RUN NO.1



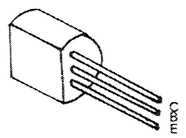

2SA933
2SA1018
2SC1473
2SA952
2SC2001
2SA1515
2SC3377



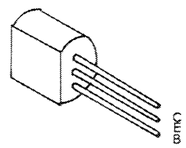

2SB772



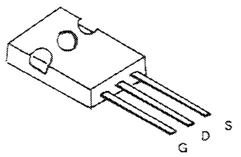

2SB536
IRF9610



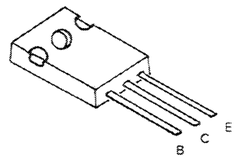
2SC3811



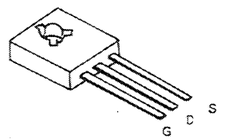
2SC2407



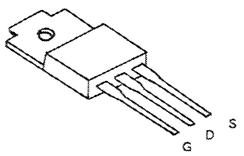

IRFPF40




HPA100




2SK699

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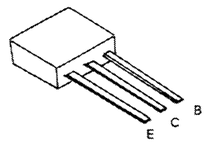


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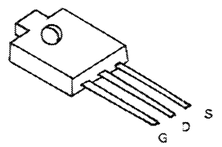


2SK947

E: EMITTER
B: BASE
C: COLLECTOR
G: GATE
D: DRAM
S: SOURCE

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